aprilia

SERVICE STATION MANUAL

677514 EN

SR MAX 300 i.e. (2011)

SERVICE STATION MANUAL

SR MAX 300 i.e. (2011)

THE VALUE OF SERVICE

As a result of continuous updates and specific technical training programmes for Aprilia products, only **Aprilia** Official Network mechanics know this vehicle fully and have the specific tools necessary to carry out maintenance and repair operations correctly.

The reliability of the vehicle also depends on its mechanical conditions. Checking the vehicle before riding it, its regular maintenance and the use of **original Aprilia spare parts** only are essential factors!

For information on the nearest **Official Dealer and/or Service Centre** consult our website:

www.aprilia.com

Only by requesting aprilia original spare parts can you be sure of purchasing products that were developed and tested during the actual vehicle design stage. All aprilia original spare parts undergo quality control procedures to guarantee reliability and durability.

The descriptions and images in this publication are given for illustrative purposes only and are not binding. While the basic characteristics as described and illustrated in this booklet remain unchanged, Piaggio & C. S.p.A. reserves the right, at any time and without being required to update this publication beforehand, to make any changes to components, parts or accessories, which it considers necessary to improve the product or which are required for manufacturing or construction reasons.

Not all versions/models shown in this publication are available in all countries. The availability of individual models should be confirmed with the official aprilia sales network.

The Aprilia trademark is the property of Piaggio & C. S.p.A.

© Copyright 2012 - Piaggio & C. S.p.A. All rights reserved. Reproduction of this publication in whole or in part is prohibited.

Piaggio & C. S.p.A. Viale Rinaldo Piaggio, 25 - 56025 PONTEDERA (PI), Italy

www.piaggio.com

SERVICE STATION MANUAL
SR MAX 300 i.e. (2011)

This manual provides the main information to carry out regular maintenance operations on your vehicle. This manual is intended to aprilia Dealers and their qualified mechanics; several concepts have been deliberately omitted as they are considered unnecessary. As it is not possible to include complete mechanical notions in this manual, users should have basic mechanical knowledge or minimum knowledge about the procedures involved when repairing scooters. Without this knowledge, repairing or checking the vehicle may be inefficient or even dangerous. As the vehicle repair and check procedures are not described in detail, be extremely cautious so as not to damage components or injure individuals. In order to optimise customer satisfaction when using our vehicles, **Piaggio & C. S.p.a.** commits itself to continually improve its products and the relative documentation. The main technical modifications and changes in repair procedures are communicated to all **Aprilia Sales Outlets and its International Subsidiaries**. These changes will be introduced in the subsequent editions of the manual. In case of need or further queries on repair and check procedures, consult **Aprilia CUSTOMER DEPARTMENT**, which will be prepared to provide any information on the subject and any further communications on updates and technical changes related to the vehicle.

NOTE Provides key information to make the procedure easier to understand and carry out.

CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

WARNING Refers to specific procedures to carry out to prevent injuries to the repairer.

Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.

Safeguarding the environment Sections marked with this symbol indicate the correct use of the vehicle to prevent damaging the environment.

Vehicle intactness The incomplete or non-observance of these regulations leads to the risk of serious damage to the vehicle and sometimes even the invalidity of the guarantee

INDEX OF TOPICS

CHARACTERISTICS	CHAR
TOOLING	TOOL
MAINTENANCE	MAIN
TROUBLESHOOTING	TROUBL
ELECTRICAL SYSTEM	ELE SYS
ENGINE FROM VEHICLE	ENG VE
ENGINE	ENG
INJECTION	INJEC
SUSPENSIONS	SUSP
BRAKING SYSTEM	BRAK SYS
COOLING SYSTEM	COOL SYS
CHASSIS	CHAS
PRE-DELIVERY	PRE DE
TIME	TIME

INDEX OF TOPICS

CHARACTERISTICS	CHAR

This section describes the general specifications of the vehicle.

Rules

This section describes general safety rules for any maintenance operations performed on the vehicle.

Safety rules

- If work can only be done on the vehicle with the engine running, make sure that the premises are well-ventilated, using special extractors if necessary; never let the engine run in an enclosed area. Exhaust fumes are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with abundant water and seek immediate medical attention.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
- Fuel is highly flammable and it can be explosive given some conditions. Do not smoke in the working area, and avoid naked flames or sparks.
- Clean the brake pads in a well-ventilated area, directing the jet of compressed air in such a way that you do not breathe in the dust produced by the wear of the friction material. Even though the latter contains no asbestos, inhaling dust is harmful.

Maintenance rules

- Use original APRILIA spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spare parts may damage the vehicle.
- Use only the appropriate tools designed for this vehicle.
- Always use new gaskets, sealing rings and split pins upon refitting.
- After removal, clean the components using non-flammable or low flash-point solvents. Lubricate all the work surfaces, except tapered couplings, before refitting these parts.
- After refitting, make sure that all the components have been installed correctly and work properly.
- For removal, overhaul and refit operations use only tools with metric measures. Metric bolts, nuts and screws are not interchangeable with coupling members with English measurement. Using unsuitable coupling members and tools may damage the vehicle.
- When carrying out maintenance operations on the vehicle that involve the electrical system, make sure the electric connections have been made properly, particularly the ground and battery connections.

Vehicle identification

To read the chassis prefix, remove the lid «**A**» in the helmet compartment.

The engine prefix «**B**» is stamped near the left shock absorber lower support.

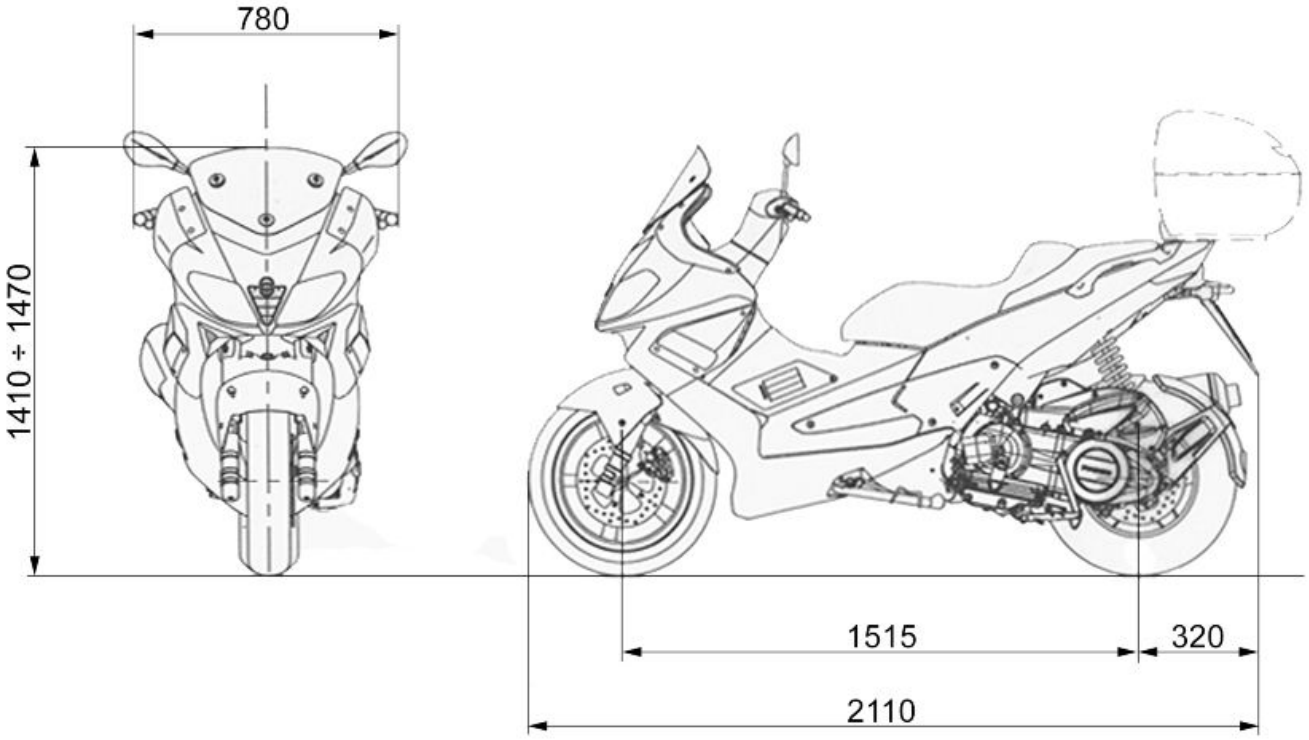
VEHICLE IDENTIFICATION

Specification	Desc./Quantity
Chassis prefix	ZAPM35600123456789
Engine prefix	M356M

Dimensions and mass

WEIGHTS AND DIMENSIONS

Specification	Desc./Quantity
Kerb weight	174 ± 5 kg
Maximum weight allowed	370 Kg



Engine

ENGINE TECHNICAL DATA

Specification	Desc./Quantity
Type	Single-cylinder, 4-stroke
Engine capacity	278 cm³
Bore x Stroke	75x63 mm
Compression ratio	11 ± 0.5 : 1
Idle speed	1700 ± 100 rpm
Timing system	4 valves, single overhead camshaft, chain-driven.
Valve clearance	Intake: 0.10 mm Exhaust: 0.15 mm
Max. power	16.1 kW at 7,250 rpm
MAX. torque	23 Nm at 6,000 rpm
Main drive	Automatic expandable pulley variator with torque server, V-belt, automatic self-ventilating centrifugal dry clutch
Final reduction gear	Gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.
Cooling	Forced coolant circulation system.
Electric start-up	Oil-coated freewheel and torque limiter.
Ignition	Electronic inductive discharge ignition, high efficiency, with separate HV coil.
Ignition advance	α/N three-dimensional map managed by control unit
Spark plug	NGK CR8EKB
Fuel system	Electronic injection with electric fuel pump
Fuel	Unleaded petrol (95 RON)
Exhaust silencer	Absorption-type exhaust muffler with catalytic converter.
Emissions compliance	EURO 3

Transmission

TRANSMISSION

Specification	Desc./Quantity
Main drive	Automatic expandable pulley variator with torque server, V-belt, automatic self-ventilating centrifugal dry clutch

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil	1.3 l
Transmission oil	250 cm³
Cooling system fluid	~ 1.8 l
Fuel tank (reserve)	approx.15.00 l (approx. 2.80 l)

Electrical system

ELECTRICAL COMPONENTS

Specification	Desc./Quantity
Starter	Electric
Ignition	Electronic inductive discharge ignition, high efficiency, with separate HV coil.
Ignition advance	α/N three-dimensional map managed by control unit
Spark plug	NGK CR8EKB
Battery	12V/14 Ah, sealed battery

Frame and suspensions

FRAME AND SUSPENSIONS

Specification	Desc./Quantity
Chassis	Tubular and steel sheets.
Front suspension	Hydraulic telescopic fork with Ø 35-mm stem
Rear suspension	Two double-acting shock absorbers, adjustable to four positions at preloading.

Brakes

BRAKES

Specification	Desc./Quantity
Front brake	Ø 260mm disc brake with hydraulic control activated by handlebar right-side lever.
Rear brake	Ø 240-mm disc brake with hydraulic control operated by the handlebar left-side lever.

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Wheel rim type	Light alloy wheel rims.
Front tyre	Tubeless, 120/70 - 15" 56P

Specification	Desc./Quantity
Rear tyre	Tubeless, 140/60 - 14" 64P
Front rim	15" x 3.00
Rear rim	14" x 3.50

TYRE PRESSURE

Specification	Desc./Quantity
Front tyre pressure (with passenger)	2.3 bar (2.3)
Rear tyre pressure (with passenger)	2.3 bar (2.5)

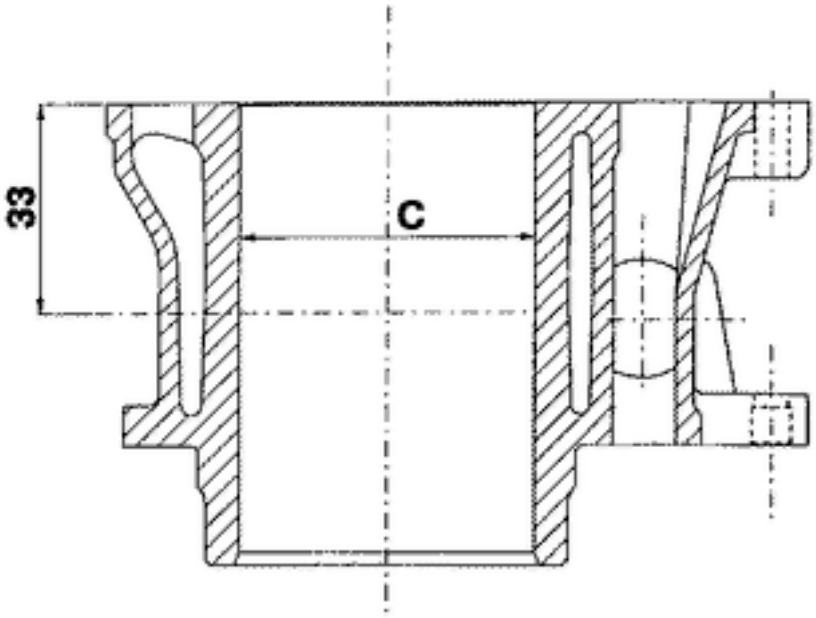
NOTE

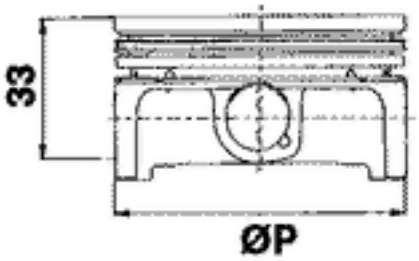
CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE. REGULATE PRESSURE ACCORDING TO THE WEIGHT OF BOTH RIDER AND ACCESSORIES

Overhaul data

Assembly clearances

Cylinder - piston assy.





CYLINDER - PISTON

Specification	Desc./Quantity
Plunger diameter	74.967 +0.014 -0.014 mm
Cylinder diameter	75 +0.038 +0.01 mm

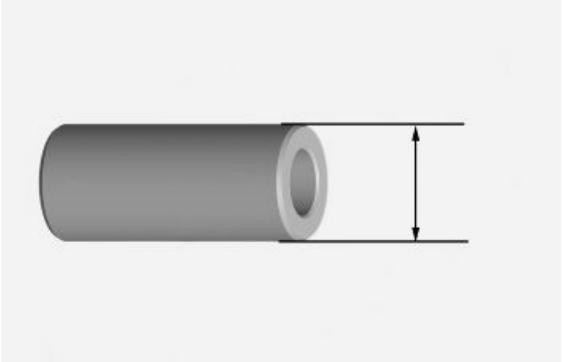
COUPLING CATEGORIES

Name	Initials	Cylinder	Piston	Play on fitting
cylinder-piston	M	75.01 ÷ 75.017	74.953 ÷ 74.960	0.050 ÷ 0.064
cylinder-piston	N	75.017 ÷ 75.024	74.960 ÷ 74.967	0.050 ÷ 0.064
cylinder-piston	O	75.024 ÷ 75.031	74.967 ÷ 74.974	0.050 ÷ 0.064
cylinder-piston	P	75.031 ÷ 75.038	74.974 ÷ 74.981	0.050 ÷ 0.064

NOTE

THE PISTON MUST BE INSTALLED WITH THE ARROW FACING TOWARDS THE EXHAUST SIDE, THE PISTON RINGS MUST BE INSTALLED WITH THE WORD «TOP» OR THE STAMPED MARK FACING UPWARDS.

- Measure the outer diameter of the gudgeon pin.

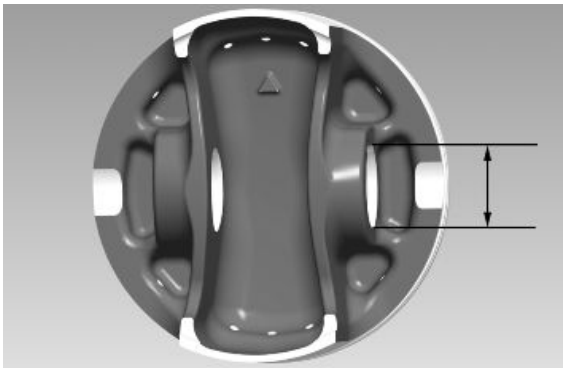


Characteristic

Pin outside diameter

16 +0 -0.004 mm

- Measure the diameter of the bearings on the piston.



Characteristic

Standard diameter

16 +0.006 +0.001 mm

- Calculate the piston pin coupling clearance.

NOTE

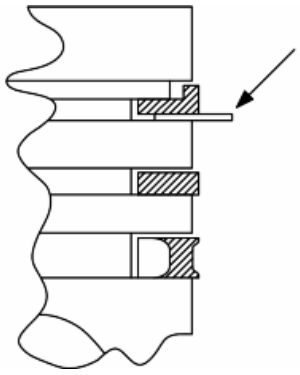
THE PIN HOUSINGS HAVE 2 LUBRICATION CHANNELS. FOR THIS REASON, MEASUREMENT MUST BE MADE ACCORDING TO THE PISTON AXIS.

Characteristic

Standard clearance:

0.001 - 0.010 mm

- Carefully clean the seal housings.
- Measure the coupling clearance between the sealing rings and the piston grooves using suitable sensors, as shown in the diagram.
- If the clearance is greater than that indicated in the table, replace the piston.



NOTE

MEASURE THE CLEARANCE BY INSERTING THE BLADE OF THE FEELER GAUGE FROM THE SECOND SEAL RING SIDE.

Fitting clearance

Top piston ring - standard coupling clearance 0.015 - 0.06 mm **Top piston ring - maximum clearance allowed after use** 0.07 mm **Middle piston ring - standard coupling clearance** 0.015 - 0.06 mm **Middle piston ring - maximum clearance allowed after use** 0.07 mm **oil scraper ring - stand-**

ard coupling clearance 0.015 - 0.06 mm **oil scraper ring - maximum clearance allowed after use**
0.07 mm

- Check that the head coupling surface is not worn or misshapen.
- Pistons and cylinders are classified according to their diameter. The coupling must be made with those of the same type (M-M, N-N, O-O, P-P).

Characteristic

Maximum allowable run-out:

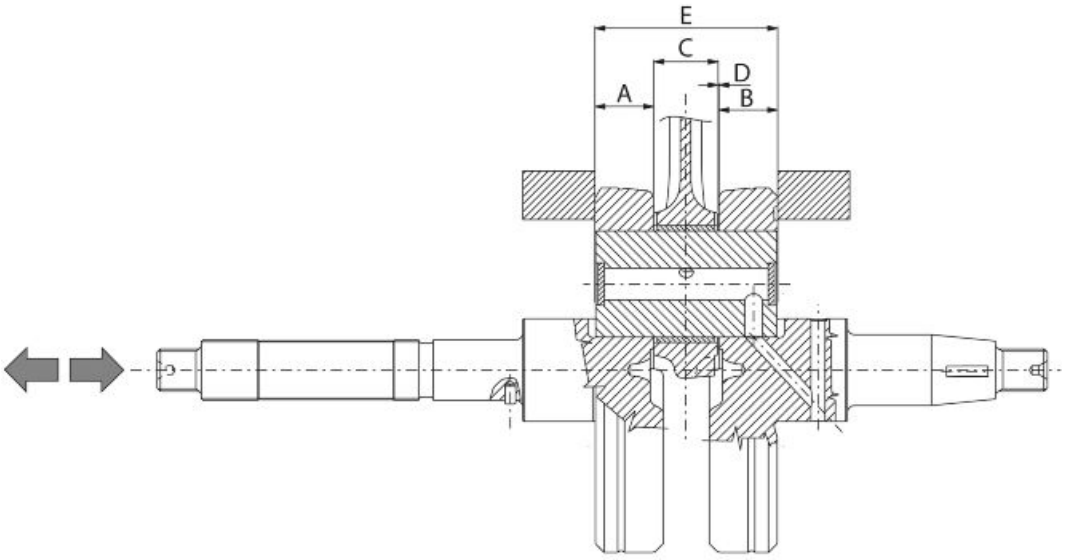
0.05 mm

Crankcase - crankshaft - connecting rod

CRANKSHAFT

Titolo	Durata/Valore	Testo Breve (< 4000 car.)	Indirizzo Immagine
Crankshaft		Axial clearance between crankshaft and connecting rod	

Axial clearance between crankshaft and connecting rod

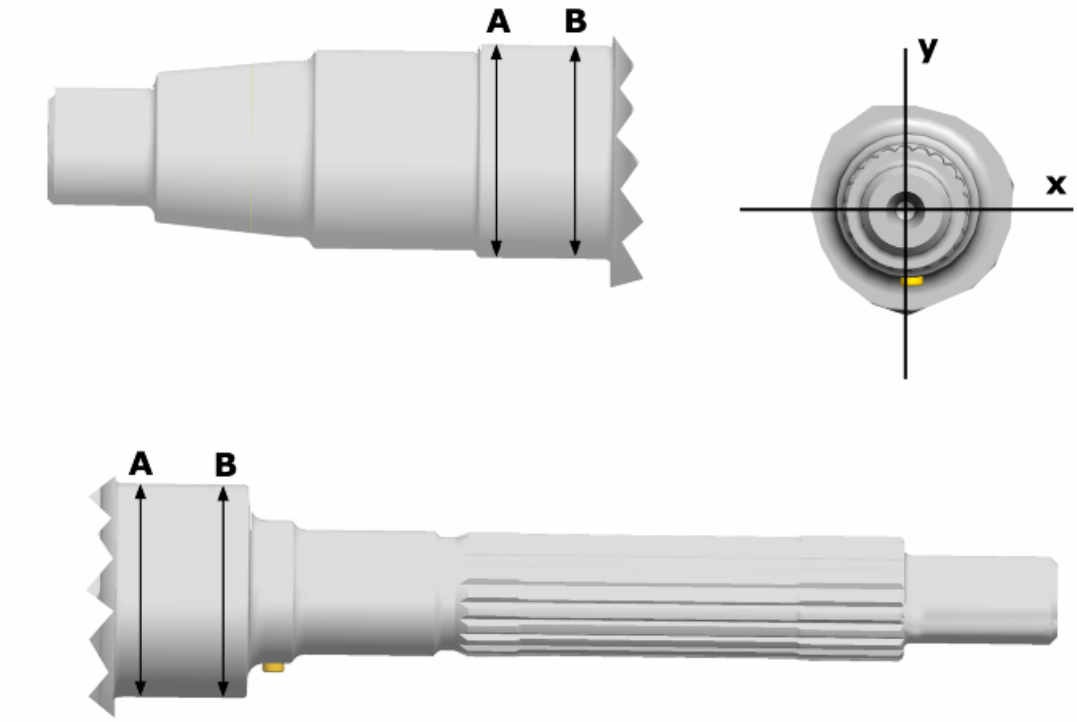


AXIAL CLEARANCE BETWEEN CRANKSHAFT AND CONNECTING ROD

Name	Description	Dimensions	Initials	Quantity
Transmissionside half-shaft		16.6 +0-0.05	A	D = 0.20 ÷ 0.50
Flywheel-side halfshaft		16.6 +0-0.05	B	D = 0.20 ÷ 0.50
Connecting rod		18 -0.10 -0.15	C	D = 0.20 ÷ 0.50
Spacer tool		51.4 +0.05	E	D = 0.20 ÷ 0.50

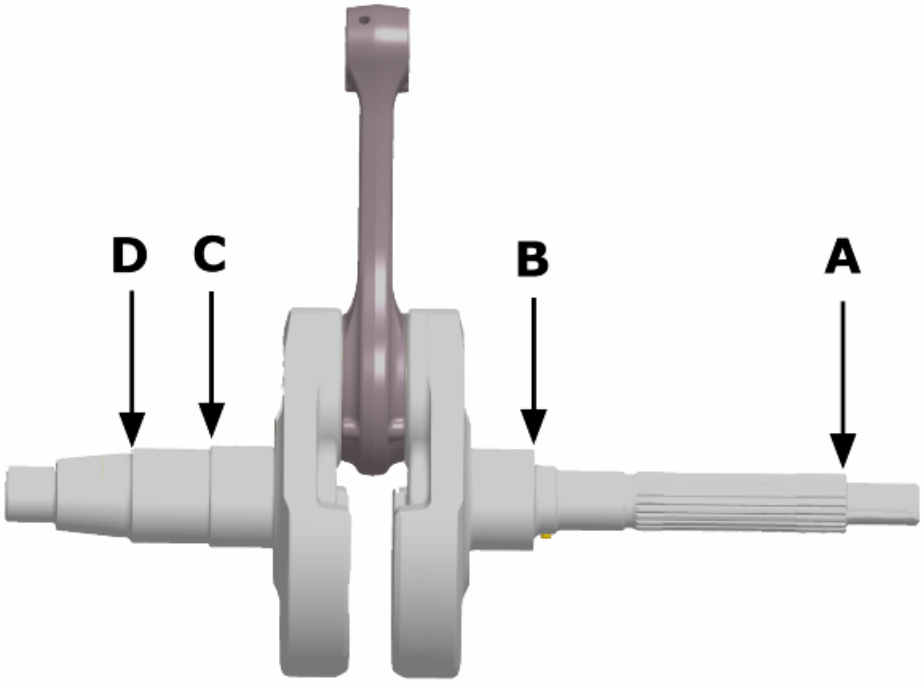
Diameter of crankshaft bearings.

Measure the bearings on both axes x-y.



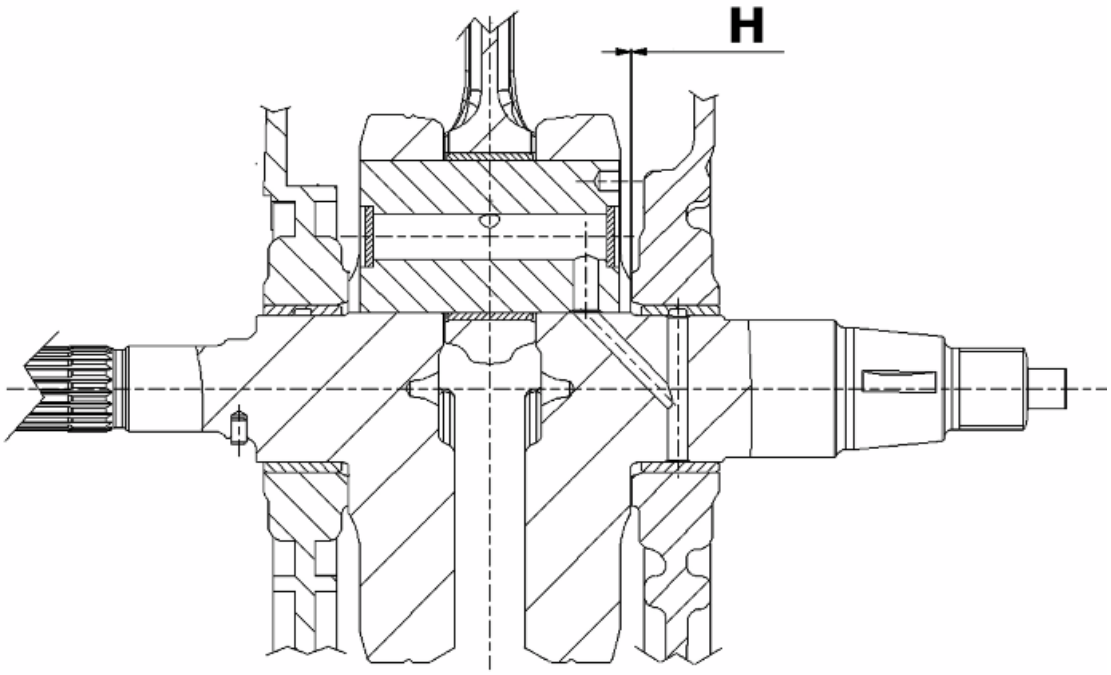
CRANKSHAFT

Specification	Desc./Quantity
Crankshaft bearings: Standard diameter: Cat. 1	28.998 ÷ 29.004 mm
Crankshaft bearings: Standard diameter: Cat. 2	29.004 ÷ 29.010 mm



MAX. ADMISSIBLE DISPLACEMENT

Specification	Desc./Quantity
A =	0.15 mm
B =	0.010 mm
C =	0.010 mm
D =	0.10 mm

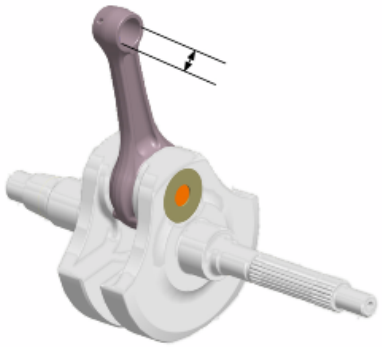


Characteristic

Crankshaft-crankcase axial clearance (H)

0.15 ÷ 0.43 mm

- Using a bore gauge, measure the connecting rod small end diameter.



NOTE

IF THE CONNECTING ROD SMALL END DIAMETER EXCEEDS THE STANDARD DIAMETER, EXHIBITS WEAR OR OVERHEATING, PROCEED TO REPLACE THE CRANKSHAFT AS DESCRIBED IN THE CRANKCASE AND CRANKSHAFT CHAPTER.

Characteristic

Standard diameter

16 +0.025 +0.015 mm

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.
- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposite the cylinder.
- To prevent shutters in the oil feeding channels, the matching surface of the two half-bearings must be perfectly orthogonal to the cylinder axis, as shown in the figure.
- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.
- Check the inside diameter of the main bushings in the three directions indicated in the diagram.
- Repeat the measurements for the other bushing half. see diagram.
- There are three crankcase versions: with BLUE bushings, with YELLOW bushings and with GREEN bushings.
- There is only one type of main bushing housing hole in the crankcase. The standard bushing diameter after driving is variable on the basis of a coupling selection.
- The bushing housings in the crankcase are classified into 2 categories - Cat. 1 and Cat. 2 - just like those for the crankshaft.
- The main bushings are available in three thickness categories, identified by colour markings, as shown in the table below.

BUSHINGS

TYPE	IDENTIFICATION	CRANKSHAFT HALF-BEARING
B	BLUE	1.973 to 1.976
C	YELLOW	1.976 to 1.979
E	GREEN	1.979 to 1.982

COUPLINGS

BUSHING CATEGORY	CRANKCASE HALVES CATEGORY	BUSHING INSIDE DIAMETER AFTER FITTING
B	2	29.024 ÷ 29.054
C	1	29.024 ÷ 29.054
	2	29.018 ÷ 29.048
E	1	29.018 ÷ 29.048

Combine the shaft with two category 1 crankwebs with the category 1 crankcase (or cat. 2 with cat. 2). Furthermore a spare crankcase cannot be matched with a crankshaft with mixed categories. The spare crankshaft has half-shafts of the same category.

CATEGORIES

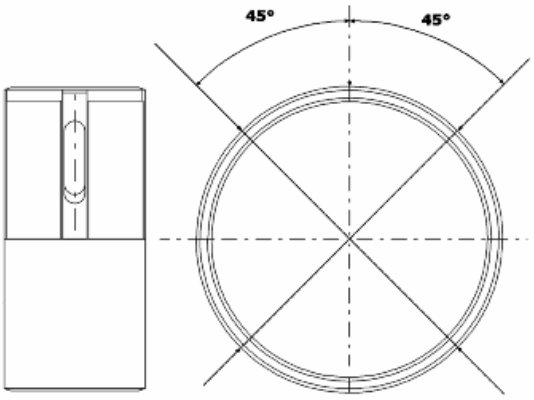
CRANKCASE HALVES	ENGINE HALF-SHAFT	BUSHING
Cat. 1	Cat. 1	E
Cat. 2	Cat. 2	B
Cat. 1	Cat. 2	C
Cat. 2	Cat. 1	C

NOTE

DO NOT TAKE THE MEASUREMENT ON THE TWO HALF-SHELL COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.

NOTE

CRANKCASES FOR REPLACEMENTS ARE SELECTED WITH CRANKCASE HALVES OF THE SAME CATEGORY AND ARE FITTED WITH CATEGORY C BUSHINGS (YELLOW)



Characteristic

Crankshaft-bushing maximum clearance admitted:

0.08 mm

Diameter of crankcase without bushing

CAT. 1: 32.959 ÷ 32.965 mm

CAT. 2: 32.953 ÷ 32.959 mm

Cylinder head

Before performing head service operations, thoroughly clean all coupling surfaces. Note the position of the springs and the valves so as not to change the original position during refitting

- Using a trued bar and a feeler gauge check that the cylinder head surface is not worn or distorted.

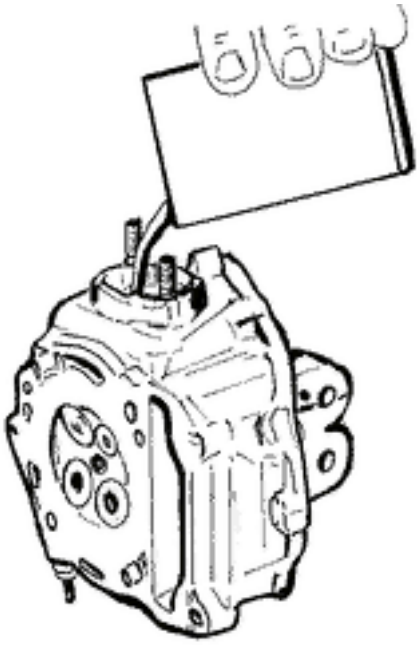
Characteristic

Maximum allowable run-out:

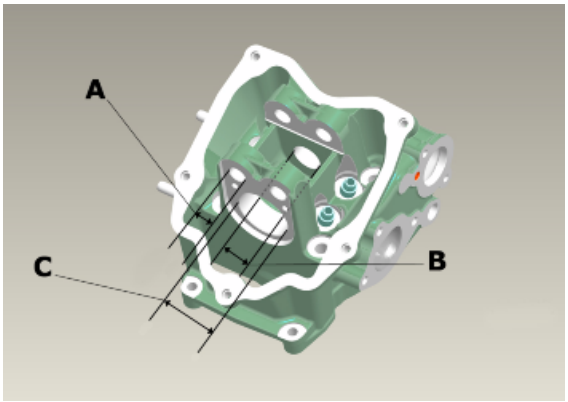
0.1 mm

- In case of faults, replace the head.

- Check the sealing surfaces for the intake and exhaust manifold.
- Check that the camshaft and the rocking lever pin capacities exhibit no wear.
- Check that the head cover surface is not worn.
- Check that the coolant seal plug exhibits no oxidation.
- Insert the valves into the cylinder head.
- Alternatively check the intake and exhaust valves.
- The test is carried out by filling the manifold with petrol and checking that the head does not ooze through the valves when these are just pressed with the fingers.



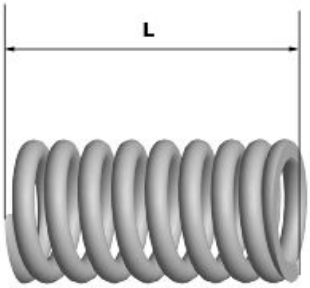
Measure the camshaft bearing seats and rocking lever support pins with a bore meter



HEAD BEARINGS

Specification	Desc./Quantity
bearing «A»	Ø 12.000 - 12.018 mm
bearing «B»	Ø 20.000 ÷ 20.021 mm
bearing «C»	Ø 37.000 - 37.025 mm

Measure the unloaded spring length



Characteristic

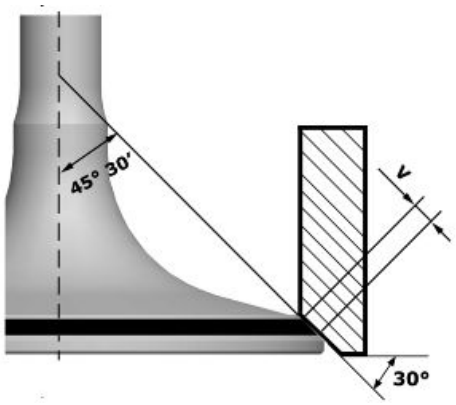
Standard length

40.2 mm

Allowable limit after use:

38.2 mm

- Clean the valve seats of any carbon residues.
- Using the Prussian blue, check the width of the impression on the valve seat "**V**".



Characteristic

Standard value:

1 - 1.3 mm

Admissible limit:

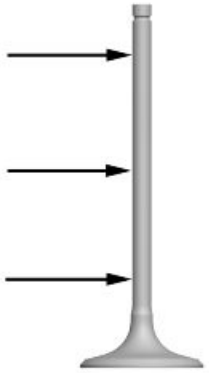
1.6 mm

- If the impression width on the valve seat is larger than the prescribed limits, true the seats with a 45° mill and then grind.
- In case of excessive wear or damage, replace the head.

STANDARD VALVE LENGTH

Specification	Desc./Quantity
Valve check Standard length	Intake: 94.6 mm
Valve check Standard length	Exhaust: 94.4 mm

- Measure the diameter of the valve stems in the three positions indicated in the diagram.



STANDARD DIAMETER

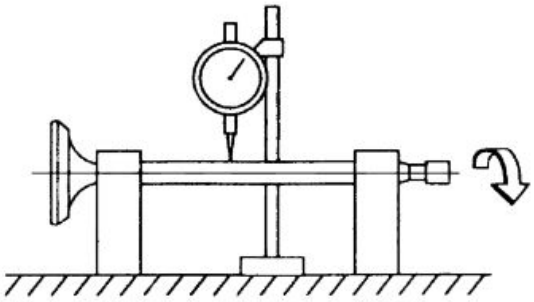
Specification	Desc./Quantity
Intake:	4.987 - 4.972 mm
Exhaust:	4.975 - 4.960 mm

MINIMUM ADMISSIBLE DIAMETER

Specification	Desc./Quantity
Intake:	4.96 mm
Exhaust:	4.945 mm

- Calculate the clearance between valve and valve guide.

- Check the deviation of the valve stem by resting it on a «**V**» shaped abutment and measuring the extent of the deformation with a dial gauge.

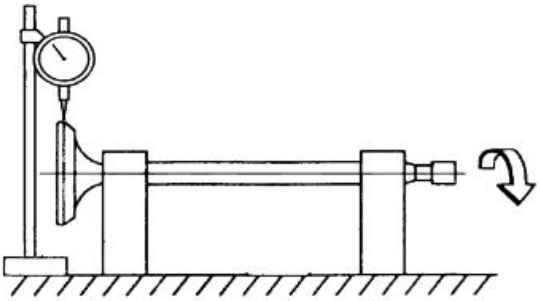


Characteristic

Limit values admitted:

0.1 mm

- Check the concentricity of the valve head by arranging a dial gauge at right angle relative to the valve head and rotate it on a "**V**" shaped abutment.

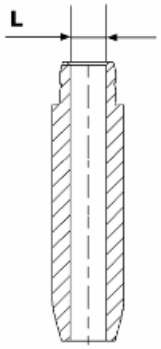


Characteristic

Admissible limit:

0.03 mm

Measure the valve guide.



Characteristic

Valve guide:

5 +0.012 mm

- After measuring the valve guide diameter and the valve stem diameter, check clearance between guide and stem.

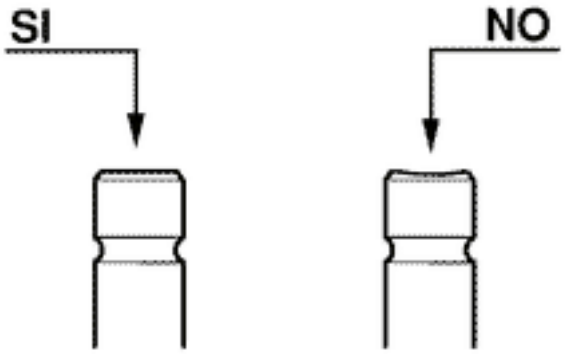
INTAKE

Specification	Desc./Quantity
Standard clearance:	0.013 - 0.04 mm
Admissible limit:	0.08 mm

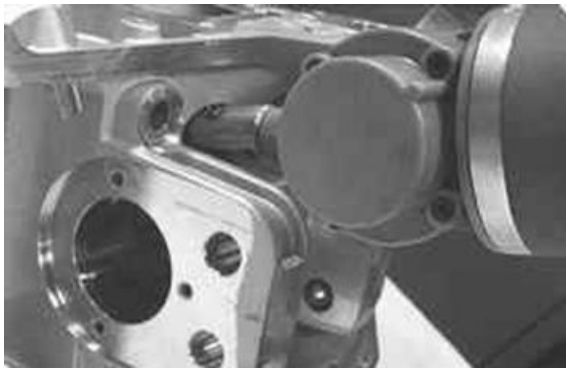
EXHAUST

Specification	Desc./Quantity
Standard clearance:	0.025 to 0.052 mm
Admissible limit:	0.09 mm

- Check that there are no signs of wear on the faying surface with the articulated set screw terminal.



- If no faults are found during the above checks, you can use the same valves. To obtain better sealing performance, grind the valve seats. Grind the valves gently with a fine-grained lapping compound. During the grinding, keep the cylinder head with the valve axes in a horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).



CAUTION

TO AVOID SCORING THE FAYING SURFACE, DO NOT KEEP ROTATING THE VALVE WHEN NO LAPPING COMPOUND IS LEFT. CAREFULLY WASH THE CYLINDER HEAD AND THE VALVES WITH A SUITABLE PRODUCT FOR THE TYPE OF LAPPING COMPOUND BEING USED.

CAUTION

DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

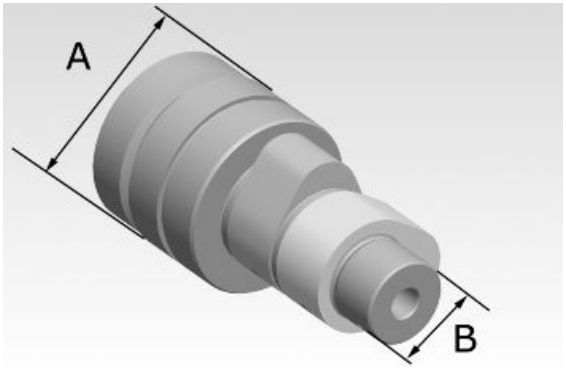
- Check that the camshaft bearings exhibit no scores or abnormal wear.
- Using a micrometer, measure the camshaft bearings.

STANDARD DIAMETER

Specification	Desc./Quantity
Camshaft check: Standard diameter	Bearing A Ø: 36.95 ÷ 36.975 mm
Camshaft check: Standard diameter	Bearing B diameter: 19.959 ÷ 19.98 mm

MINIMUM ADMISSIBLE DIAMETER

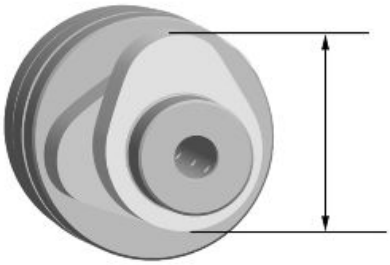
Specification	Desc./Quantity
Camshaft check: Minimum admissible diameter	Bearing A Ø: 36.94 mm
Camshaft check: Minimum admissible diameter	Bearing B diameter: 19.950 mm



-Using a gauge, measure the cam height.

STANDARD HEIGHT

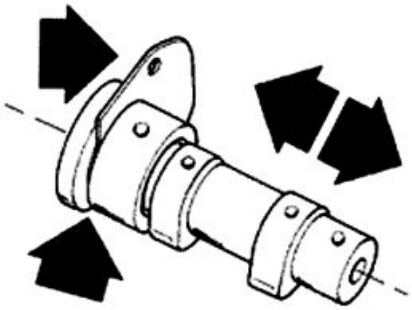
Specification	Desc./Quantity
Camshaft check: Standard height	Intake: 30.285 mm
Camshaft check: Standard height	Exhaust: 29.209 mm



Check the axial clearance of the camshaft

CAMSHAFT AXIAL CLEARANCE

Specification	Desc./Quantity
Camshaft check: Standard axial clearance:	0.11 - 0.41 mm
Camshaft check: Maximum admissible axial clearance	0.42 mm



- Measure the outside diameter of the rocking lever pins
- Check the rocking lever pins do not show signs of wear or scoring.
- Measure the internal diameter of each rocker.

Check there are no signs of wear on the slider from contact with the cam and on the jointed adjustment plate.

ROCKING LEVERS AND PIN DIAMETER:

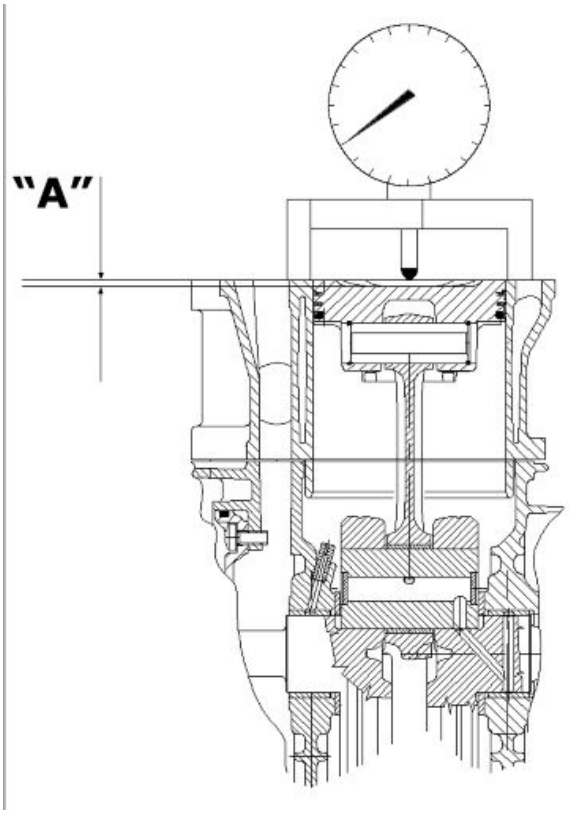
Specification	Desc./Quantity
Rocking lever inside diameter: Standard diameter	Diameter 12.000 - 12.011 mm
Rocking lever pin diameter: Standard diameter	Diameter 11.977 - 11.985 mm

Slot packing system

Characteristic

Compression ratio

10.5 ÷ 11.5 : 1



Measurement "**A**" to be taken is a value of piston re-entry, it indicates by how much the plane formed by the piston crown falls below the plane formed by the top of the cylinder. The further the piston falls inside the cylinder, the less the base gasket to be applied (to recover the compression ratio) and vice versa.

NOTE

MEASUREMENT "A" MUST BE TAKEN WITHOUT ANY GASKET FITTED BETWEEN THE CRANKCASE AND CYLINDER AND AFTER RESETTING THE DIAL GAUGE, EQUIPPED WITH A SUPPORT, ON A GROUND PLANE

ENGINE 300 SHIMMING

Name	Measure A	Thickness
SHIMMING	3.70 - 3.60	0.4 ± 0.05
SHIMMING	3.60 - 3.40	0.6 ± 0.05
SHIMMING	3.40 - 3.30	0.8 ± 0.05

Products

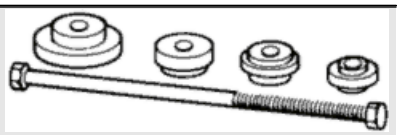
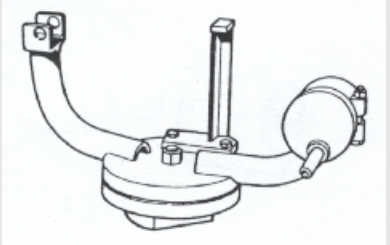
RECOMMENDED PRODUCTS TABLE

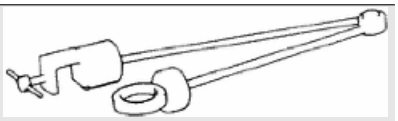
Product	Description	Specifications
AGIP GEAR SAE 80W-90	Lubricant for gearboxes and transmissions.	API GL-4
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3
AGIP GP 330	Water repellent springy calcium spray grease.	R.I.D./A.D.R. 2 10°b) 2 R.I.Na. 2.42 - I.A.T.A. 2 - I.M.D.G. class 2 UN 1950 Pag. 9022 EM 25-89
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3
AGIP BRAKE 4	Brake fluid.	Synthetic fluid SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4
AGIP PERMANENT SPECIAL	Ethylene glycol-based antifreeze fluid with organic inhibition additives. Red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16
AUTOSOL METAL POLISH	Silencer cleaning paste	special product for cleaning and polishing stainless steel silencer
AGIP GREASE PV2	Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.	TL 9150 066, symbol NATO G 460
AGIP GREASE SM 2	Gray black smooth-textured lithium grease, containing molybdenum disulphide.	-

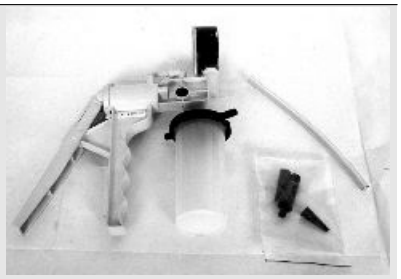
INDEX OF TOPICS

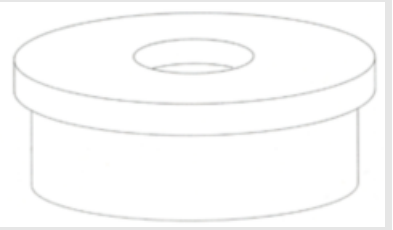
TOOLING	TOOL

SPECIFIC TOOLS

Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y014	Calliper to extract ø 15-mm bearings	
005095Y	Engine support	
002465Y	Calliper for circlips	
020459Y	Punch for fitting bearing on steering tube	
020004Y	Punch for removing steering bearings from headstock	
020055Y	Wrench for steering tube ring nut	

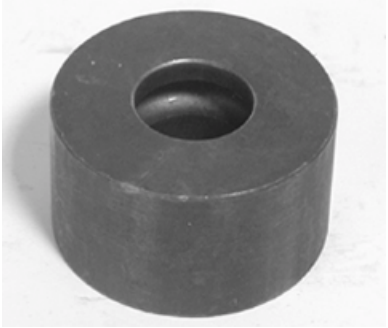
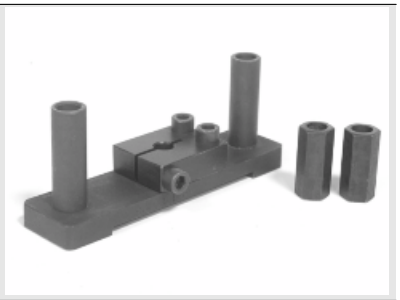
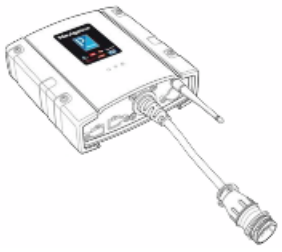
Stores code	Description	
020074Y	Support base for checking crankshaft alignment	
020150Y	Air heater mounting	
020151Y	Air heater	
020193Y	Oil pressure check gauge	
020262Y	Crankcase splitting plate	
020263Y	Driven pulley assembly sheath	

Stores code	Description	
020306Y	Punch for assembling valve seal rings	
020329Y	Vacuum pump Mity-Vac	
020330Y	Stroboscopic light to check timing	
020331Y	Digital multimeter	
020332Y	Digital rpm indicator	

Stores code	Description	
020648Y	Single battery charger	
020335Y	Magnetic mounting for dial gauge	
020357Y	32x35-mm Adaptor	
020359Y	42 x 47-mm adaptor	
020360Y	52x55-mm Adaptor	
020363Y	20-mm guide	

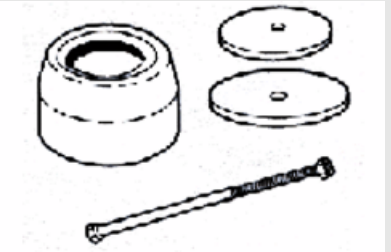
Stores code	Description	
020375Y	28 x 30 mm adaptor	
020376Y	Adapter handle	
020382Y	Valve cotters equipped with part 012 removal tool	
020382Y011	adapter for valve removal tool	
020393Y	Piston assembly band	
020412Y	15-mm guide	

Stores code	Description	
020423Y	Driven pulley lock wrench	
020424Y	Driven pulley roller casing fitting punch	
020426Y	Piston fitting fork	
020431Y	Valve oil seal extractor	
020434Y	Oil pressure check fitting	
020444Y	Tool for fitting/ removing the driven pulley clutch	

Stores code	Description	
020456Y	Ø 24 mm adaptor	
020477Y	37 mm adaptor	
020483Y	30 mm guide	
020489Y	Hub cover support stud bolt kit	
020428Y	Piston position check mounting	
020680Y	Diagnosis Tool	

Stores code	Description	
020621Y	HV cable extraction adaptor	
020481Y	Control unit interface wiring	
001467Y035	Bell for 47-mm outside diameter bearings	
020626Y	Driving pulley lock wrench	
001467Y013	Calliper to extract ø 15-mm bearings	
020627Y	Flywheel lock wrench	

Stores code	Description	
020454Y	Pin lock fitting tool	
020467Y	Flywheel extractor	
020622Y	Transmission-side oil seal punch	
020480Y	Petrol pressure check kit	
020244Y	15-mm diameter punch	
020115Y	Ø 18 punch	

Stores code	Description	
020271Y	Tool for removing-fitting silent bloc	
020469Y	Reprogramming kit for vehicle diagnostic tester	
020487Y	Fork oil seal extractor	

INDEX OF TOPICS

MAINTENANCE	MAIN

Maintenance chart

SCHEDULED MAINTENANCE TABLE

***I**: CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY.*
***C**: CLEAN, **R**: REPLACE, **A**: ADJUST, **L**: LUBRICATE*
Clean the SAS air filter every 2 years
** Replace every 2 years*

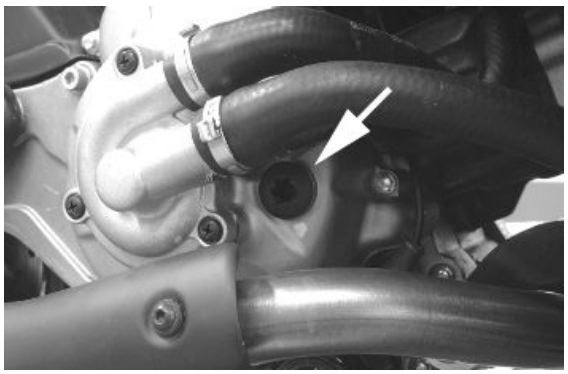
km x 1,000	1	5	10	15	20	25	30	35	40	45	50	55	60
Safety fasteners	I		I				I				I		I
Spark plug			R		R		R		R		R		R
Driving belt				R			R			R			R
Throttle control	A		A		A		A		A		A		A
Air filter			C		C		C		C		C		C
Belt compartment air filter			I		I		I		I		I		I
Oil filter	R		R		R		R		R		R		R
Oil filter (mesh)	C												
Valve clearance					A				A				A
Electrical system and battery	I		I		I		I		I		I		I
Brake fluid *	I		I		I		I		I		I		I
Coolant *	I		I		I		I		I		I		I
Engine oil	R	I	R	I	R	I	R	I	R	I	R	I	R
Hub oil	R		I		R		I		R		I		R
Brake pads	I	I	I	I	I	I	I	I	I	I	I	I	I
Sliding shoes / CVT rollers			R		R		R		R		R		R
Tyre pressure and wear	I		I		I		I		I		I		I
Vehicle road test	I		I		I		I		I		I		I
Suspension			I		I		I		I		I		I
Steering	A		A		A		A		A		A		A
Centre stand			L								L		

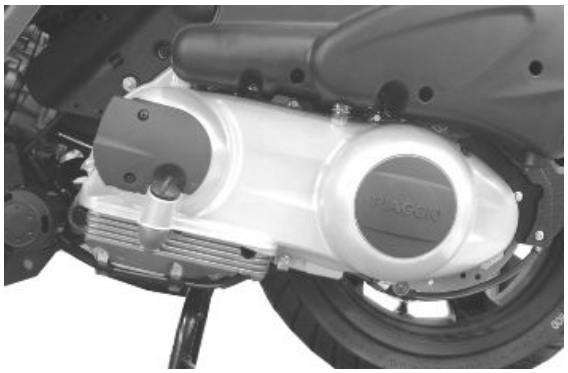
Checking the spark advance

The ignition advance is determined electronically on the basis of parameters known by the control unit. For this reason it is not possible to interpret the reference values based on the engine rpm. The ignition advance value is detectable at any time using the diagnostic tester. It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.

Proceed as follows:

- Remove the spark plug.
- Remove the transmission crankcase.
- Rotate the driving pulley fan until the reference marks between the flywheel and flywheel cover coincide as shown in the photograph.





- Bring the reference mark onto the transmission side between the fan and the transmission cover as shown in the picture.
- Refit the spark plug.
- Refit the plastic cap on the flywheel cover.
- Adjust the spark gap to the contact position (no reference mark visible) and install it on the engine between the spark plug and spark plug cap
- Connect the induction clamp on the spark gap cable respecting the proper polarity (the arrow on the clamp must be pointing at the spark plug).
- Connect the diagnostic tester.
- Start the engine.
- Select the «Parameters» function in this menu.
- Set the stroboscopic light control to the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tester.

If the values do not correspond, check:

- distribution timing
- revolution timing sensor
- injection control unit

Specific tooling

020680Y Diagnosis Tool

020330Y Stroboscopic light to check timing

020621Y HV cable extraction adaptor

Spark plug

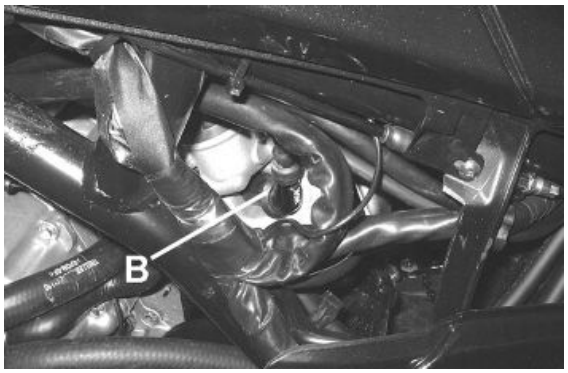
Proceed as follows:

1. Remove the right side cover unscrewing the 3 «**A**» screws;
2. Disconnect the spark plug HV wire hood «**B**» ;
3. Unscrew the spark plug using the wrench supplied. ;

4. When refitting, place the spark plug in the hole at the due inclination and tighten it by hand until it is finger tight;

5. Only use the wrench to lock it in place;

6. Push hood «**B**» fully over the spark plug.

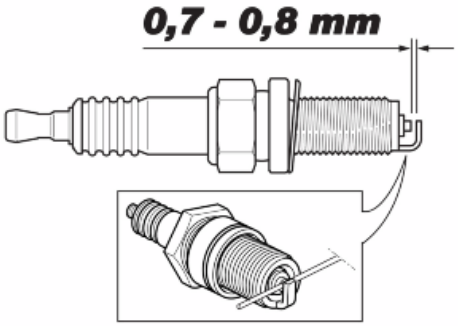


WARNING

THE USE OF SPARK PLUGS OTHER THAN THOSE RECOMMENDED OR A SHIELDLESS SPARK PLUG CAP COULD CAUSE DISTURBANCES TO THE SYSTEM.

WARNING

THE SPARK PLUG MUST BE REMOVED WHEN THE ENGINE IS COLD. REPLACE THE SPARK PLUG AS INDICATED IN THE SCHEDULED MAINTENANCE TABLE. THE USE OF ELECTRONIC CENTRAL UNITS AND OF NON-COMPLIANT ELECTRONIC IGNITIONS OR SPARK PLUGS OTHER THAN THOSE PRESCRIBED MAY SERIOUSLY DAMAGE THE ENGINE.



Characteristic

Spark plug

NGK CR8EKB

Electric characteristic

Electrode gap

0.7 to 0.8 mm

Locking torques (N*m)

Spark plug **12 ÷ 14**

Hub oil

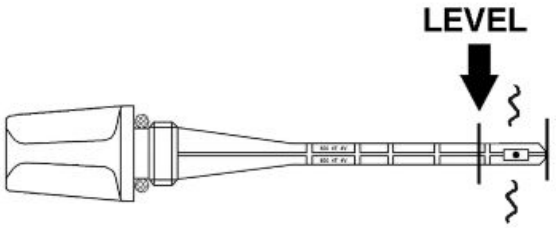
Check

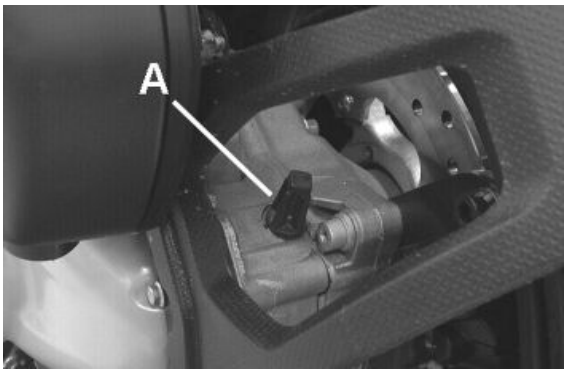
-Place the vehicle on the centre stand on flat ground;

- Remove the oil dipstick «**A**», dry it with a clean cloth and put it back into its hole **tightening it completely**;

Remove the dipstick and check that the oil level is slightly over the second notch starting from the lower end; if the level is under the MAX. mark, it needs to be filled with the right amount of hub oil.

-Screw up the oil dipstick again and make sure it is locked properly into place.



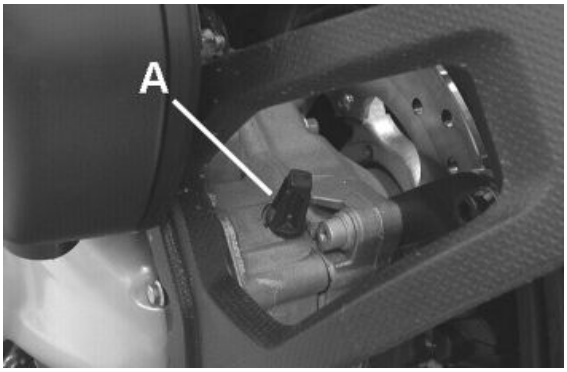


Replacement

-Remove the oil filler cap «**A**».

- Unscrew the oil drainage cap «**B**» and drain out all the oil.

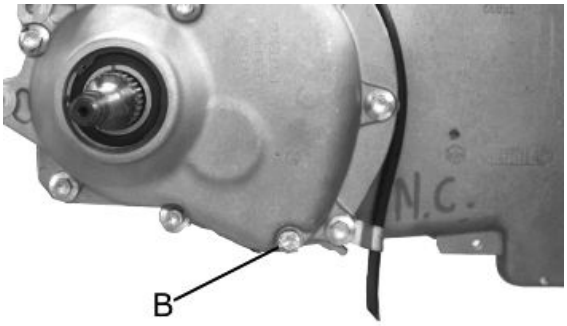
- Screw in the drainage cap again and fill the hub with the prescribed oil.



Recommended products

AGIP GEAR SAE 80W-90 Lubricant for gear-boxes and transmissions.

API GL-4



Characteristic

Rear hub oil

Capacity approximately 250 cc

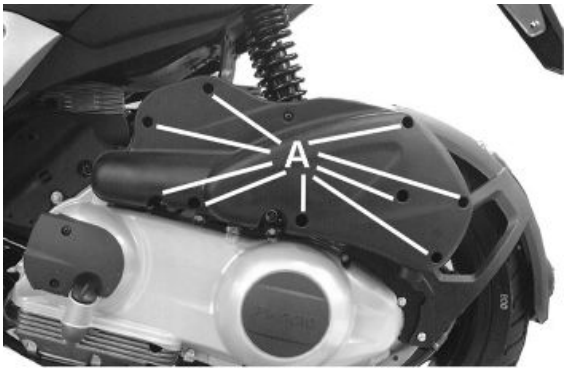
Locking torques (N*m)

Hub oil drainage screw 15 to 17 Nm

Air filter

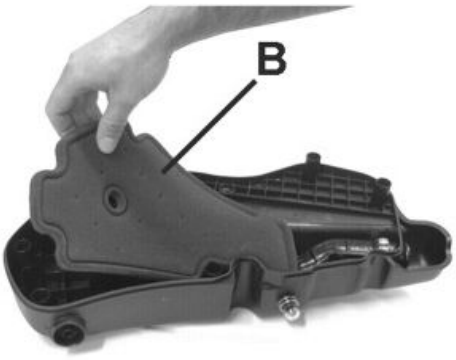
Proceed as follows:

1. Unscrew the 9 fixing screws «**A**»;
2. Remove the air filter«**B**»



CAUTION

IF THE VEHICLE IS USED ON DUSTY ROADS IT IS NECESSARY TO CARRY OUT MAINTENANCE CHECKS OF THE AIR FILTER MORE OFTEN TO AVOID DAMAGING THE ENGINE.



1. Wash the sponge with water and neutral soap.

2. Dry it with a clean cloth and small blasts of compressed air.

3. Soak the sponge with a mixture of 50% petrol and 50% specified oil.

4. Gently squeeze the filter element without twisting it, let it drip and then refit it.

CAUTION

IF THE VEHICLE IS USED ON DUSTY ROADS IT IS NECESSARY TO CARRY OUT MAINTENANCE CHECKS OF THE AIR FILTER MORE OFTEN TO AVOID DAMAGING THE ENGINE.

Recommended products

AGIP FILTER OIL Special product for the treatment of foam filters.

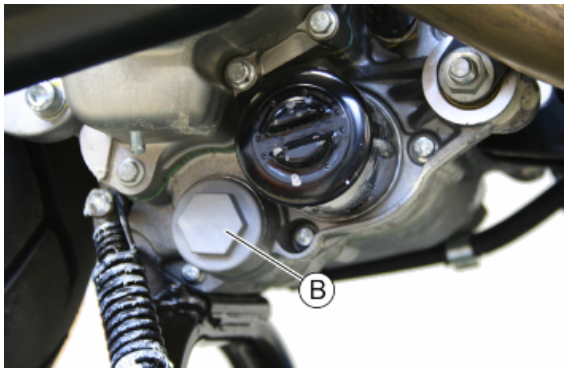
-

Engine oil

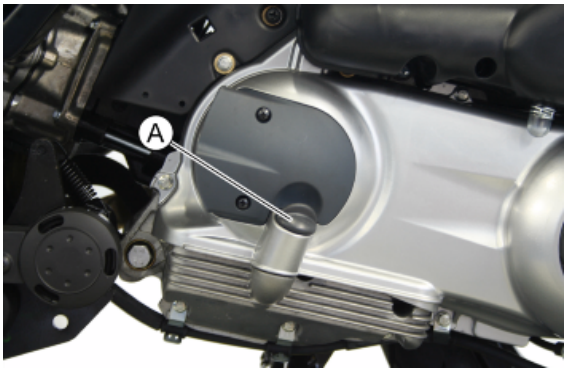
In four stroke engines, the engine oil is used to lubricate the distribution elements, the bench bearings and the thermal group. **An insufficient quantity of oil can cause serious damage to the engine.** In all four stroke engines, the deterioration of the oil characteristics, or a certain consumption should be considered normal, especially if during the run-in period. Consumption levels in particular can be influenced by the conditions of use (e.g.: oil consumption increases when driving at "full throttle".

Replacement

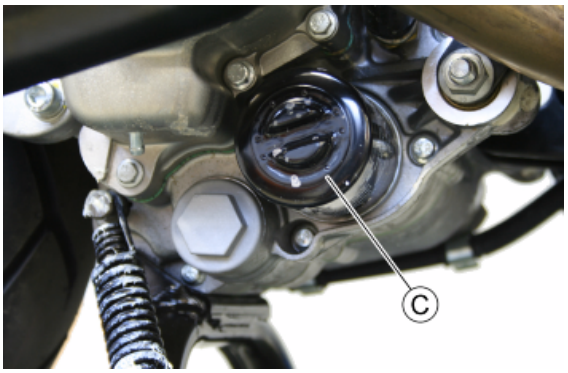
Change oil and replace filter as indicated in the scheduled maintenance table. Empty the engine by draining the oil through drainage plug «**B**».



To facilitate oil drainage, loosen the cap/dipstick «**A**».



Once all the oil has drained through the drainage hole, unscrew and remove the oil cartridge filter «**C** ».



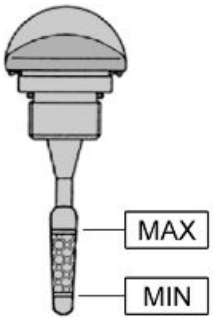
Make sure the pre-filter and drainage plug O-rings are in good conditions.

Lubricate them and refit the mesh filter and oil drainage plug, screwing them up to the specified torque.

Refit the new cartridge filter being careful to lubricate the O-ring before fitting it.

Change the engine oil.

Since a certain quantity of oil still remains in the circuit, engine oil must be added through plug «**A**». Then start the scooter, leave it running for a few minutes and switch it off: after five minutes check the level and if necessary top up without exceeding the **MAX** level. The cartridge filter must be replaced every time the oil is changed. Use new oil of the recommended type for topping up and changing purposes.



NOTE

THE ENGINE MUST BE HOT WHEN THE OIL IS CHANGED.

Recommended products

eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

Locking torques (N*m)

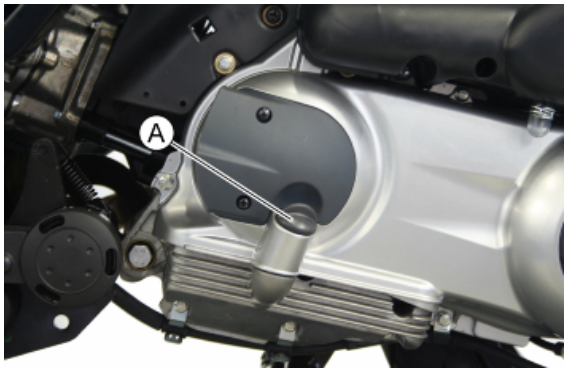
Oil filter 4 to 6 **Engine oil drainage plug** 24 to 30

Check

This operation must be carried out with the engine cold and following the procedure below:

- Place the vehicle on its centre stand and on flat ground.
- Unscrew the cap/dipstick «**A**», dry it with a clean cloth and reinsert it, **screwing it all the way down**.
- Remove the cap/dipstick again and check that the level is between the min and max reference marks; top-up, if required.

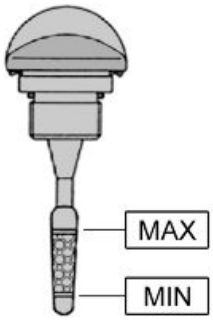
If the check is carried out after the vehicle has been used, and therefore with a hot engine, the level line will be lower; in order to carry out a correct check, wait at least 10 minutes after the engine has been stopped so as to get the correct level.



Oil top up

The oil should be topped up after having checked the level and in any case by adding oil **without ever exceeding the MAX. level**.

Restoring the level from the **MIN** to the **MAX** marks requires approx. **400 m³** of oil.



Engine oil filter

The cartridge filter must be replaced every time the oil is changed. Use new oil of the recommended type for topping up and changing purposes.

Make sure the pre-filter and drainage plug O-rings are in good conditions. Lubricate them and refit the mesh filter and the oil drainage plug, screwing them up to the prescribed torque. Refit the new cartridge filter being careful to lubricate the O-ring before fitting it. Change the engine oil.

Recommended products

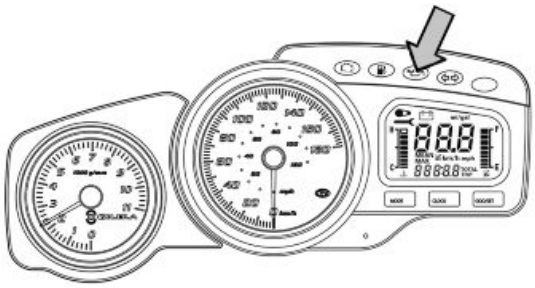
eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.
JASO MA, MA2 - API SL - ACEA A3

Oil pressure warning light

Warning light (low oil pressure)

The vehicle is equipped with a warning light on the instrument panel that lights up when the key is turned to the «**ON**» position. However, this light should switch off once the engine has been started.

If the light comes on during braking, at idling speed or while turning, it is necessary to first switch off the engine and then to check the oil level and the lubrication system



Checking the ignition timing

- Remove the plastic cap on the flywheel cover
-Turn the flywheel until the reference mark «**T**» on the rotor matches the reference mark on the flywheel cover as shown in the figure (TDC). Make sure that the 4V reference point on the camshaft control pulley is aligned with the reference point on the head as shown in the second figure. If the reference is opposite the indicator on the head, turn the crankshaft once more.
For the use of this reference mark, remove the spark plug and turn the engine in the direction that is the reverse of the normal direction using a calliper spanner applied to the camshaft command pulley casing.

Cooling system

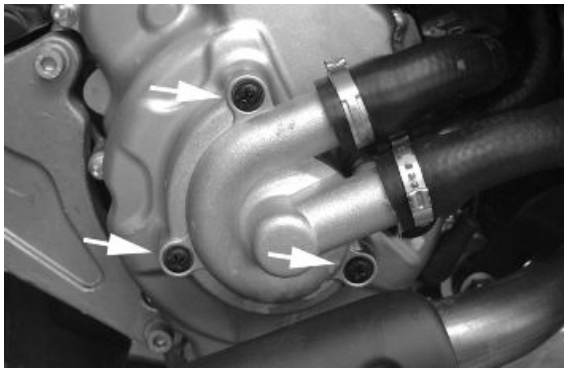
If noise or liquid leaks through the drain bore of the water pump is detected, it will be necessary to replace the pump as described in the «Flywheel cover» Chapter.
Proceed to carry out a few preliminary operations as described below:

- Place the vehicle on its centre stand and on flat ground.
- Empty the cooling system by removing the couplings on the pump cover and the filler plug on the expansion tank.

CAUTION

THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

- Remove the water pump cover as indicated in the figure by loosening the 3 fixing screws.
- Proceeding as described in chapter «Engine», partially drain the system and overhaul the pump.
- Refill and drain the system again once after having repaired the damaged and reinstalled all the components.



NOTE

FOR CHANGING THE COOLANT AND BLEEDING THE SYSTEM, SEE CHAPTER "COOLING SYSTEM".

Characteristic

Cooling system

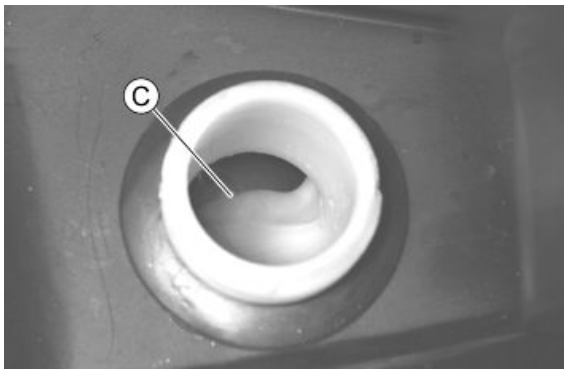
approx. 1.8 litres

Level check

Check coolant level when the engine is cold and as indicated in the scheduled maintenance table, following the steps below:

- Place the vehicle on its centre stand and on flat ground.
- Remove the expansion tank cap.
- To check the level, it is necessary to look inside the expansion tank:

Reference «**C**» shows the adequate coolant level.



-The coolant consists of an ethylene glycol and corrosion inhibitor based 50% de-ionised water- anti-freeze solution mix.

CAUTION

DO NOT EXCEED THE MAX. LEVEL WHEN FILLING SO AS TO AVOID THE COOLANT ESCAPING FROM THE EXPANSION TANK WHEN THE VEHICLE IS IN USE.

NOTE

THE COOLANT CONSISTS OF A MIXTURE OF DE-IONISED WATER AND FLUID FOR SEALED CIRCUITS. THE MIXTURE THUS OBTAINED LOWERS THE FREEZING POINT OF THE COOLANT TO - 40°C. THE MIXTURE IN COMBINATION WITH THE PRESSURE OF 0.9 BAR RAISES THE BOILING POINT TO APPROX. 125°C. THE RECOMMENDED LIQUID ALSO PROVIDES PROTECTIVE FUNCTIONS FOR THE ALUMINIUM ALLOYS. THIS CHARACTERISTIC MAY DECREASE OVER THE COURSE OF TIME; THIS IS WHY A PERIODIC REPLACEMENT OF THE COOLANT IS INDISPENSABLE.

NOTE

FOR THE REPLACEMENT OF THE COOLANT AND THE FLUSHING OF THE SYSTEM, SEE CHAPTER COOLING SYSTEM.

Braking system

Level check

- Position the vehicle on a flat surface and on the centre stand.
- Check the brake fluid level via the special indicator located on the pump.

NOTE

THE LEVEL TENDS TO DROP AS THE BRAKE PADS GET WORN, A MINIMUM LEVEL SHOULD NOT BE REACHED. IF THE LEVEL IS TOO LOW, CHECK AND FIX THE SYSTEM SEALS, IF REQUIRED. TOP UP THE PUMP RESERVOIR, IF REQUIRED, CONSIDERING THAT THE "MAX." LEVEL MUST ONLY BE OBTAINED WITH NEW PADS.

Top-up

CAUTION

ONLY USE DOT 4-CLASSIFIED BRAKE FLUID.

Proceed as follows:

- Position the vehicle on a flat surface and on the centre stand.
- Remove the tank cap by removing the two screws, remove the gasket and top up using only the liquid specified without exceeding the maximum level.

CAUTION

AVOID CONTACT OF THE BRAKE FLUID WITH YOUR EYES, SKIN, AND CLOTHING. IN CASE OF ACCIDENTAL CONTACT, WASH WITH WATER.

WARNING

BRAKING CIRCUIT FLUID IS HIGHLY CORROSIVE; DO NOT LET IT COME INTO CONTACT WITH THE PAINTED PARTS.

WARNING

THE BRAKE FLUID IS HYGROSCOPIC, THAT IS, IT ABSORBS MOISTURE FROM THE SURROUNDING AIR. IF THE HUMIDITY IN THE BRAKING FLUID EXCEEDS A CERTAIN VALUE, IT WILL LEAD TO INEFFICIENT BRAKING; FOR THIS REASON, NEVER USE BRAKING FLUID FROM CONTAINERS THAT HAVE ALREADY BEEN OPENED, OR PARTIALLY USED.

Recommended products

AGIP BRAKE 4 Brake fluid.

Synthetic fluid SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4

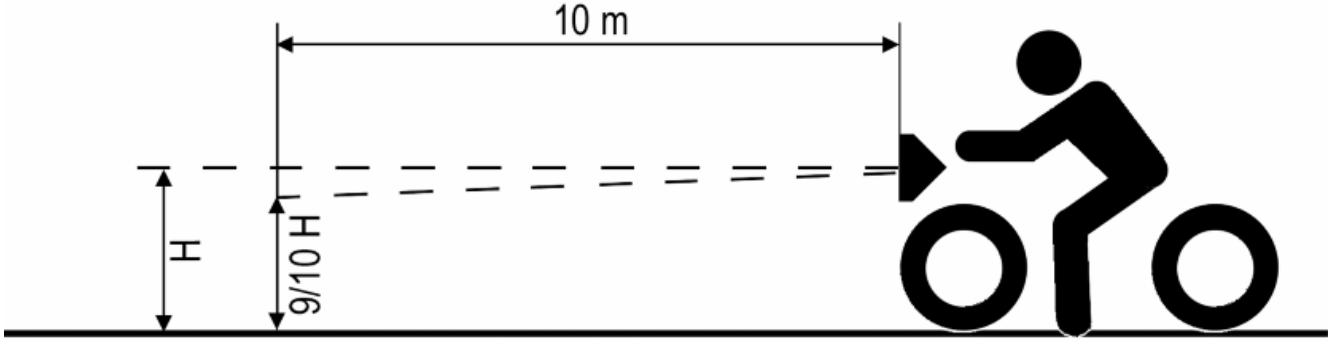
Under standard climatic conditions, replace coolant as indicated in the scheduled maintenance table.

NOTE

SEE THE BRAKING SYSTEM CHAPTER WITH REGARD TO THE CHANGING OF BRAKE FLUID AND THE BLEEDING OF AIR FROM THE CIRCUITS.

Headlight adjustment

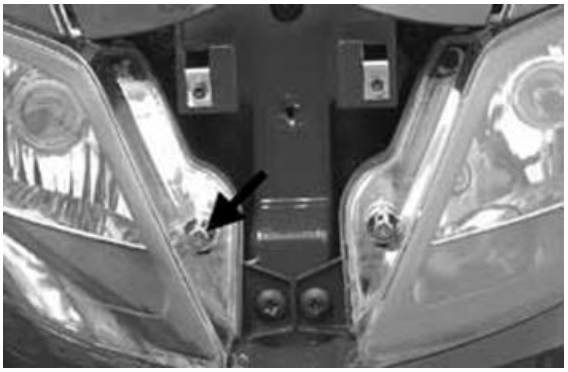
- Place the vehicle in use conditions, with tyres inflated to the prescribed pressure on flat ground at 10 m from a white screen placed in dim light.
- Make sure that the scooter axle is perpendicular to the screen.
- Turn the headlight on and check that the limit of the light beam projected onto the screen does not exceed 9/10 of the headlight centre height from the ground and that it is not less than 7/10.



- Otherwise, adjust the right headlight by the screw shown in the figure, which can be accessed by removing the front shield connecting member.

NOTE

THE ABOVE PROCEDURE COMPLIES WITH THE EUROPEAN STANDARDS REGARDING MAXIMUM AND MINIMUM HEIGHT OF LIGHT BEAMS. REFER TO THE STATUTORY REGULATIONS IN FORCE IN EVERY COUNTRY WHERE THE VEHICLE IS USED.



INDEX OF TOPICS

TROUBLESHOOTING	TROUBL

This section makes it possible to find what solutions to apply when troubleshooting.

For each failure, a list of the possible causes and pertaining operations is given.

Engine

Poor performance

POOR PERFORMANCE

Possible Cause	Operation
Fuel pump	Check the injection load relay
Excess of scales in the combustion chamber	Descale the cylinder, the piston, the head and the valves
Incorrect timing or worn timing system elements	Time the system again or replace the worn parts
Obstructed muffler	Replace
Filtro aria otturato o sporco	Smontare la spugna, lavare con acqua e shampoo, quindi impregnarla con una miscela al 50% di benzina e olio specifico, successivamente spremerla tra le mani senza strizzarla, lasciarla sgocciolare e rimontarla.
Oil level exceeds maximum	Check for causes and fill to reach the correct level
Lack of compression: parts, cylinder and valves worn	Replace the worn parts
Drive belt worn	Replace
Inefficient automatic transmission	Check the rollers, the pulley movement and make sure the drive belt is in good conditions; replace the damaged parts and lubricate the moveable driven pulley with specific grease.
Clutch slipping	Check the clutch system and/or the bell and replace if necessary
Overheated valves	Remove the head and the valves, grind or replace the valves
Wrong valve adjustment	Adjust the valve clearance properly
Valve seat distorted	Replace the head unit

Excessive oil consumption/Exhaust smoke

EXCESSIVE CONSUMPTION

Possible Cause	Operation
Wrong valve adjustment	Adjust the valve clearance properly
Overheated valves	Remove the head and the valves, grind or replace the valves
Misshapen/worn valve seats	Replace the head unit
Worn cylinder, Worn or broken piston rings	Replace the piston cylinder assembly or piston rings
Worn or broken piston rings or piston rings that have not been fitted properly	Replace the piston cylinder unit or just the piston rings
Oil leaks from the couplings or from the gaskets	Check and replace the gaskets or restore the coupling seal
Worn valve oil seal	Replace the valve oil seal
Worn valve guides	Check and replace the head unit if required

Insufficient lubrication pressure

LOW LUBRICATION PRESSURE

Possible Cause	Operation
By-Pass remains open	Check the By-Pass and replace if required. Carefully clean the By-Pass area.
Oil pump with excessive clearance	Perform the dimensional checks on the oil pump components
Oil filter too dirty	Replace the cartridge filter
Oil level too low	Restore the level adding the recommended oil type

Transmission and brakes

Clutch grabbing or performing inadequately

IRREGULAR CLUTCH PERFORMANCE OR SLIPPAGE

Possible Cause	Operation
Faulty clutch	Check that there is no grease on the masses. Check that the clutch mass faying surface with the bell is mainly in the centre with equivalent characteristics on the three masses. Check that the clutch housing is not scored or worn in an anomalous way

Insufficient braking

INEFFICIENT BRAKING SYSTEM

Possible Cause	Operation
Inefficient braking system	Check the pad wear (1.5 min). Check that the brake discs are not worn, scored or warped. Check the correct level of fluid in the pumps and change brake fluid if necessary. Check there is no air in the circuits; if necessary, bleed the air. Check that the front brake calliper moves in axis with the disc.
Fluid leakage in hydraulic braking system	Failing elastic fittings, plunger or brake pump seals, replace
Brake disc slack or distorted	Check the brake disc screws are locked; measure the axial shift of the disc with a dial gauge and with wheel mounted on the vehicle.

Brakes overheating

BRAKE OVERHEAT

Possible Cause	Operation
Defective plunger sliding	Replace the calliper.
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the vehicle to measure the axial shift of the disc.
Clogged compensation holes on the pump	Clean carefully and blast with compressed air
Swollen or stuck rubber gaskets	Replace the calliper.

Steering and suspensions

Heavy steering

STEERING HARDENING

Possible Cause	Operation
Steering hardening	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the rotation seats and the steering fifth wheels.

Excessive steering play

EXCESSIVE STEERING CLEARANCE

Possible Cause	Operation
Torque not conforming	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the rotation seats and the steering fifth wheels.

Noisy suspension

NOISY SUSPENSION

Possible Cause	Operation
Faults in the suspension system	If the front suspension is noisy, check: tightening torques, headstock components, inspect forks.

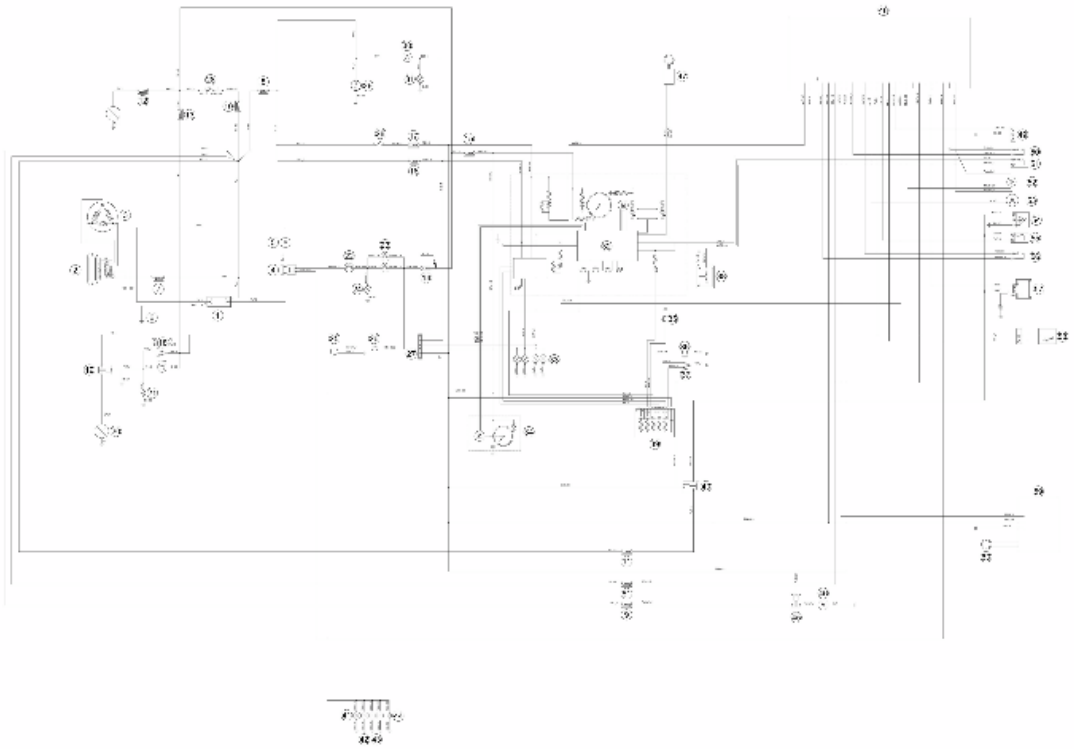
Suspension oil leakage

OIL LEAKAGE FROM SUSPENSION

Possible Cause	Operation
Faulty or broken seals	Replace the shock absorber

INDEX OF TOPICS

ELECTRICAL SYSTEM	ELE SYS



KEY

1. Battery 12V - 14Ah

2. Voltage regulator

3. Magneto flywheel

4. Starter solenoid

5. Starter motor

6. Engine ground

7. Fuses No. 01 - 30A

8. Fuses No. 02 - 15A

9. N. 03 - 15A Fuse

10. Fuses No. 04 - 15A

11. Fuses No. 05 - 10A

12. Fuses No. 06 - 7.5A

13. Fuses No. 07 - 7.5A

14. Fuses No. 08 - 7.5A

15. Fuses No. 09 - 7.5A

16. Fuses No. 10 - 7.5A

17. Fuses No. 11 - 7.5A

18. Light switch

19. High-beam light solenoid

20. High beam bulb 12v-55w
21. High beam warning light 12v-1.2w
22. Starter button
23. N.2 stop buttons
24. Stop light bulb 12v-21/5w
25. Horn 12v c.c.
26. Horn button
27. Pre-installation for anti-theft device
28. Ignition key contact
29. Max 12v-180w socket
30. Helmet compartment light switch
31. Helmet compartment lighting bulb 12v-5w
32. Instrument panel
33. Bulbs 12V-10W for turn indicators
34. Analogue rpm indicator
35. Oil pressure sensor
36. Remote mode button
37. Turn indicator switch
38. Fuel level transmitter
39. Electrical control device
40. Electronic control unit remote control switch
41. Rear daylight running light bulb 12v-21/5w
42. Bulb 12v-5w for license plate lamp
43. 2 bulbs 12v-5w for front daylight running light
44. Bulb 12v-1.2w for daylight running warning light
45. Radiator electric fan remote control
46. Radiator electric fan
47. Wheel speed sensor
48. Injection ECU
49. Diagnosis
50. Coolant temperature sensor for c.d.i.
51. Coolant sensor for instrument
52. Stand button
53. Engine stop switch
54. Fuel pump
55. Fuel injector
56. Lambda sensor
57. HV coil

58. Engine speed sensor

59. Decoder

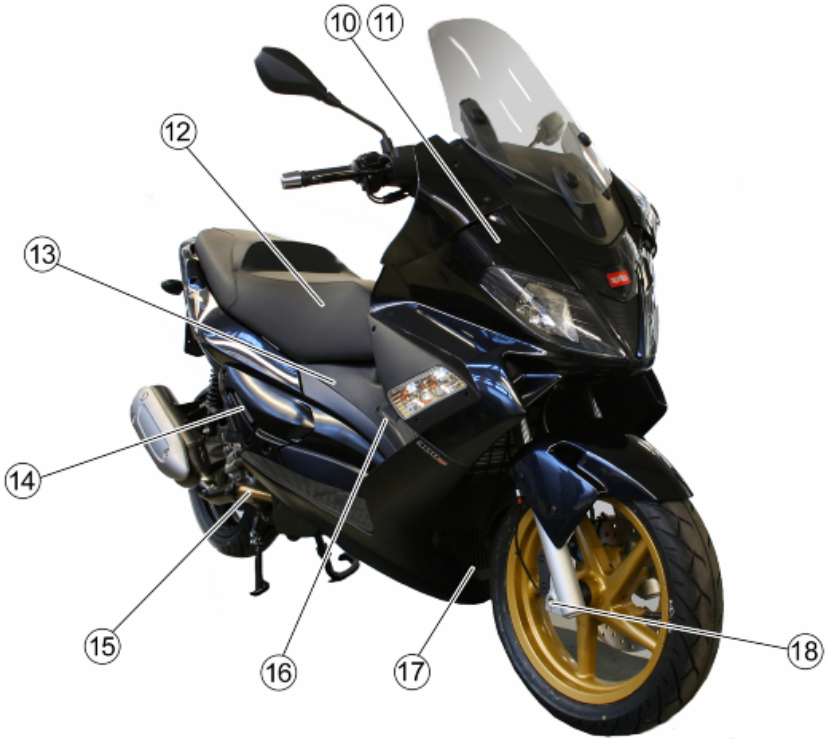
60. Aerial

61. Fuses No. 12 - 7.5A

KEY

Ar: Orange **Az:** Sky Blue **Bi:** White **Bl:** Blue **Gi:** Yellow **Gr:** Grey **Ma:** Brown **Ne:** Black **Ro:** Pink **Rs:** Red **Ve:** Green **Vi:** Purple

Components arrangement



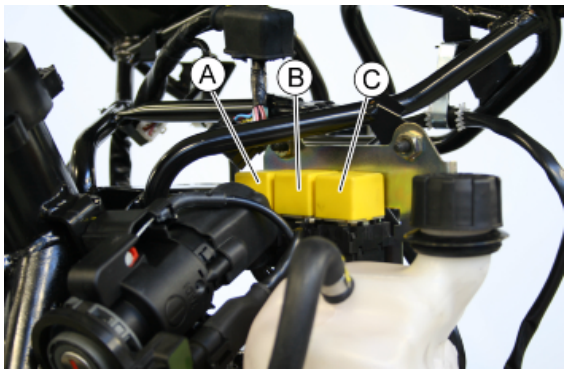
1. Remote controls

Remove the legshield to reach it.

A. Electric fan remote control

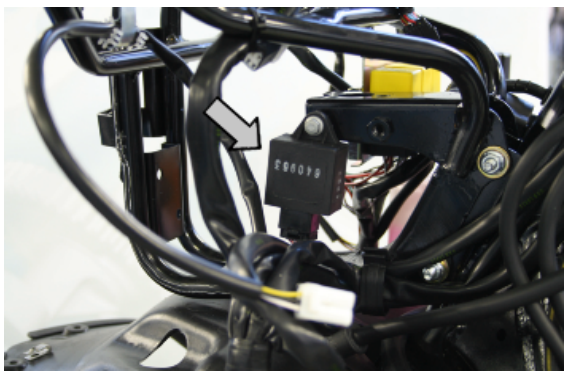
B. High-beam light remote control

C. Injection load remote control



2. Electrical control device

Remove the legshield to reach it.

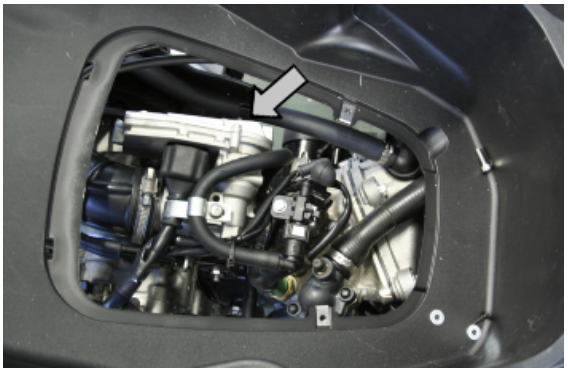


3. Main fuses

To reach it, remove the battery cover placed in the helmet compartment.

4. Injection ECU

To reach it, remove the inspection compartment placed in the helmet compartment.



5. Auxiliary fuses

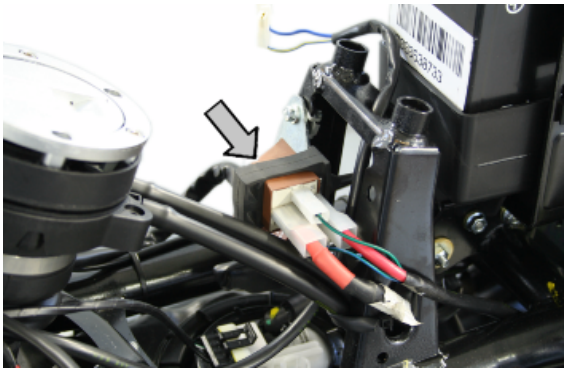
Located in the helmet compartment.

6. Starter motor

Remove the helmet compartment to reach it.

7. Starter remote control

Remove the central chassis cover to reach it.

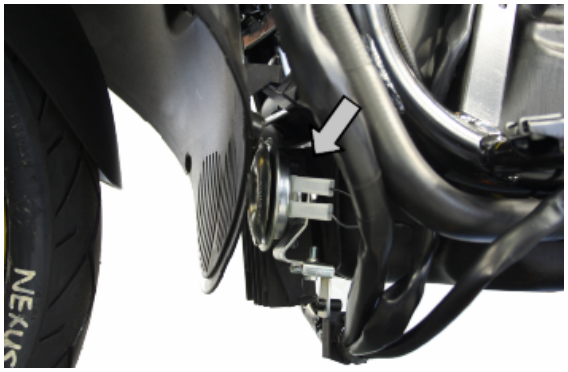


8. Stand button

Remove the left footrest to reach them.

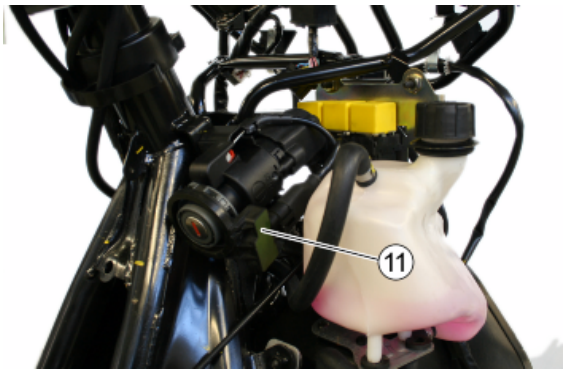
9. Horn

To reach it, remove the lower cover.



10-11. Key switch/Immobilizer aerial

Remove the shield back plate to reach it.

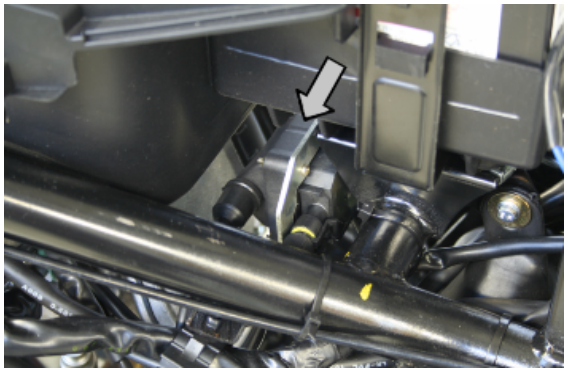


12. Battery

To reach it, remove the battery cover placed in the helmet compartment.

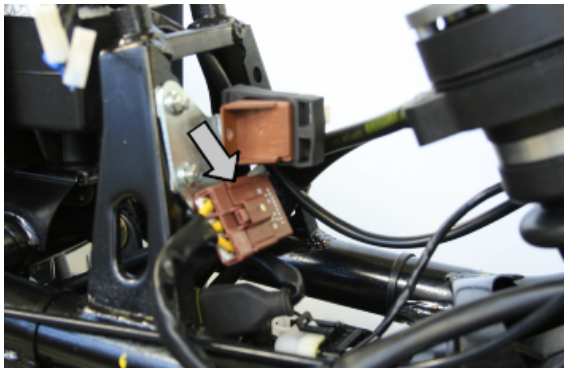
13. HV coil

Remove the right side fairing to reach it.



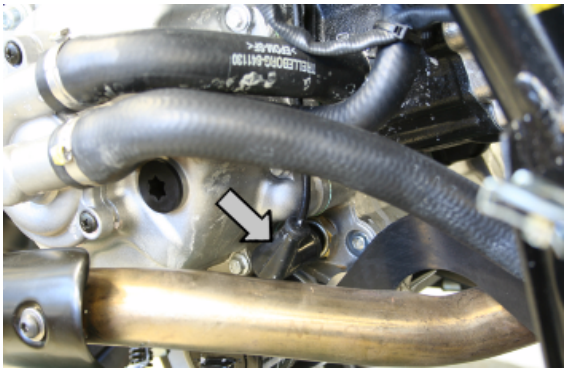
14. Magneto flywheel

The connector is located near the fuel pump. To reach it, remove the central chassis cover.



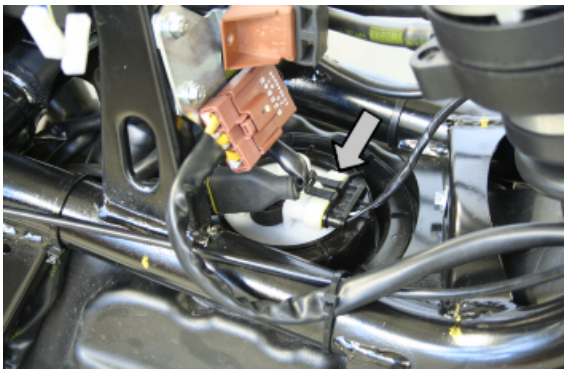
15. Oil pressure sensor

On the engine, on the right-hand side of the vehicle.



16. Fuel level transmitter

To reach it, remove the central chassis cover. The transmitter is integrated to the fuel pump.



17. Voltage regulator

To reach it, remove the lower cover.

18.Wheel turning sensor

In the front wheel, on the right-hand side.

Ground points

A. Ground points on the chassis

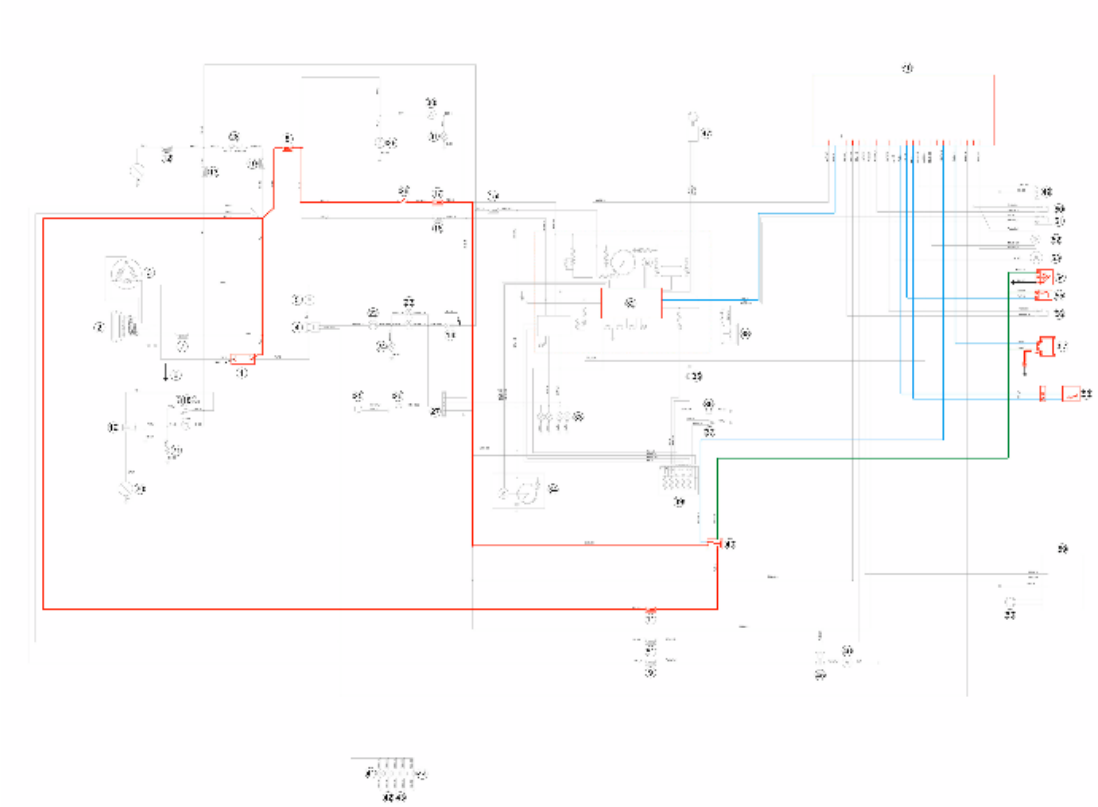
To reach them, remove the right footrest.

B. Ground point on the engine

To reach it, remove the inspection compartment placed in the helmet compartment.

Conceptual diagrams

Ignition



KEY

1. Battery 12V - 14Ah

6. Engine ground

8. Fuses No. 02 - 15A

11. Fuses No. 05 - 10A

17. Fuses No. 11 - 7.5A

28. Ignition key contact

32. Instrument panel

40. Electronic control unit remote control switch

48. Injection ECU

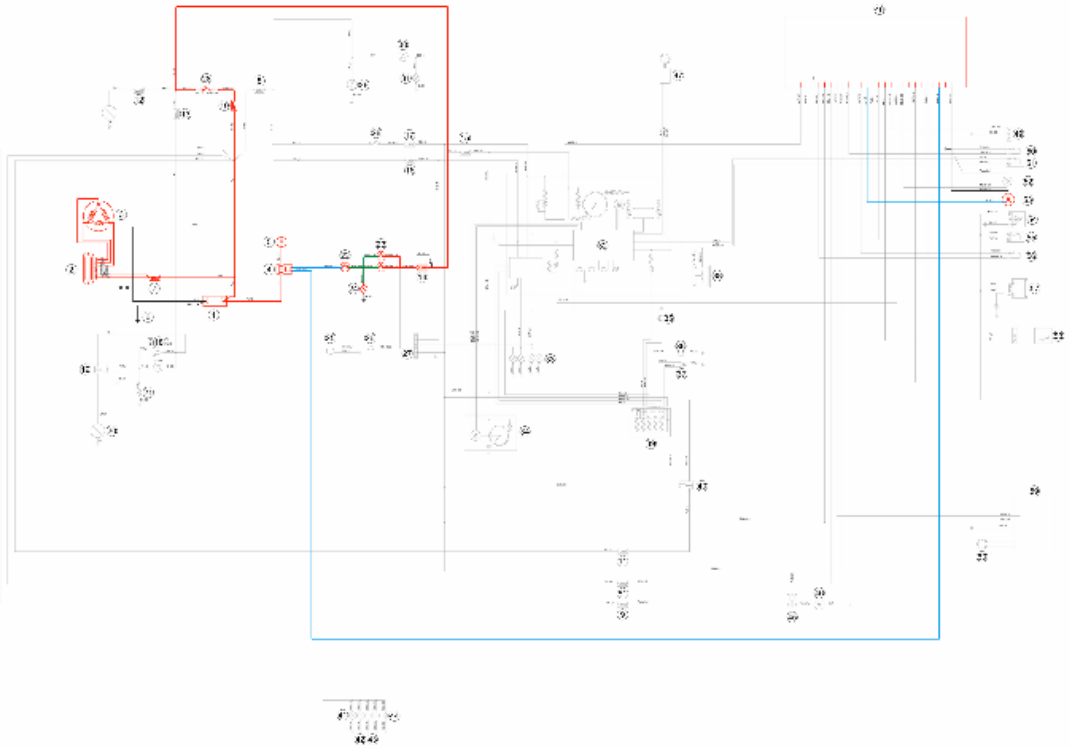
54. Fuel pump

55. Fuel injector

57. HV coil

58. Engine speed sensor

Battery recharge and starting



KEY

1. Battery 12V - 14Ah

2. Voltage regulator

3. Magneto flywheel

4. Starter solenoid

5. Starter motor

6. Engine ground

7. Fuses No. 01 - 30A

8. Fuses No. 02 - 15A

10. Fuses No. 04 - 15A

14. Fuses No. 08 - 7.5A

22. Starter button

23. N.2 stop buttons

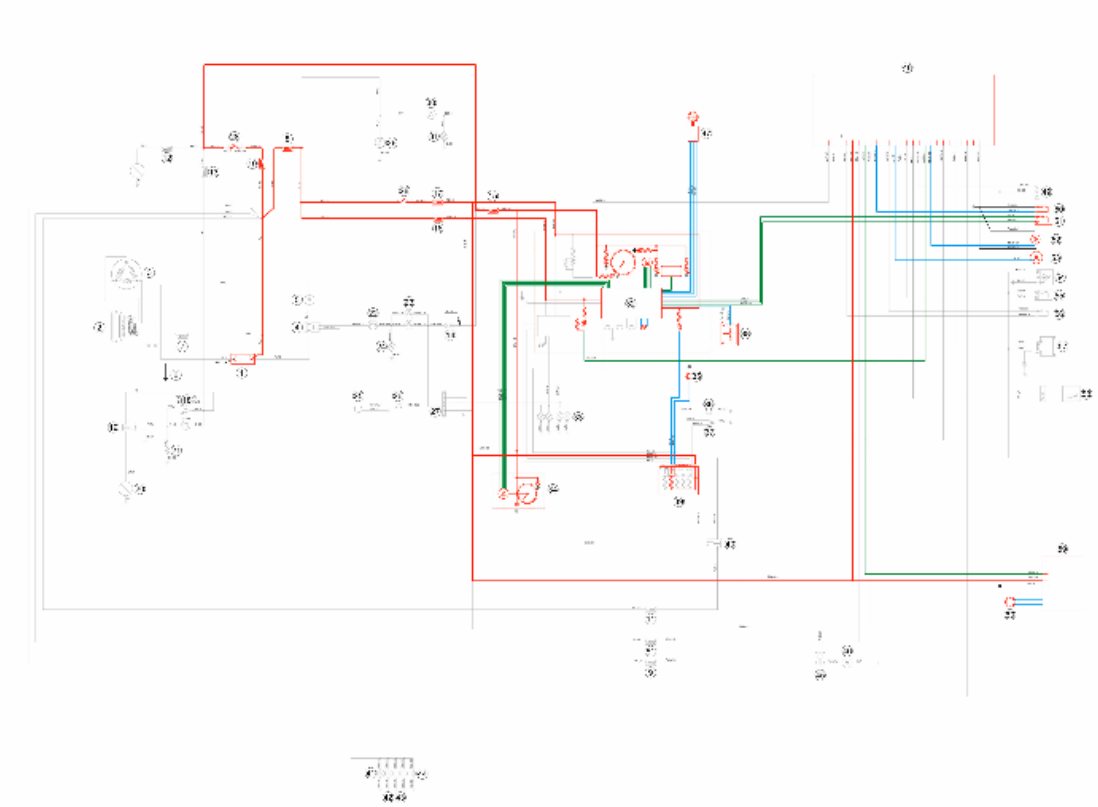
24. Stop light bulb 12v-21/5w

28. Ignition key contact

48. Injection ECU

53. Engine stop switch

Level indicators and enable signals section



KEY

1. Battery 12V - 14Ah

6. Engine ground

8. Fuses No. 02 - 15A

10. Fuses No. 04 - 15A

15. Fuses No. 09 - 7.5A

16. Fuses No. 10 - 7.5A

17. Fuses No. 11 - 7.5A

28. Ignition key contact

32. Instrument panel

34. Analogue rpm indicator

35. Oil pressure sensor

38. Fuel level transmitter

39. Electrical control device

47. Wheel speed sensor

48. Injection ECU

50. Coolant temperature sensor for c.d.i.

51. Coolant sensor for instrument

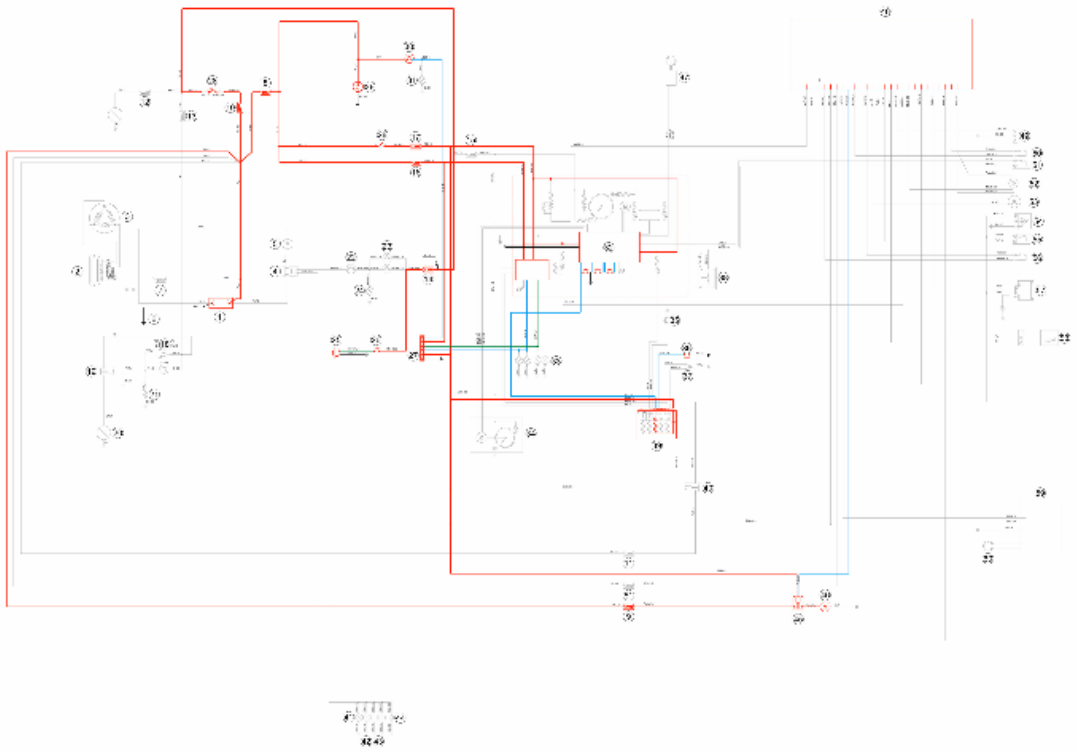
52. Stand button

53. Engine stop switch

59. Decoder

60. Aerial

Devices and accessories



KEY

1. Battery 12V - 14Ah

6. Engine ground

8. Fuses No. 02 - 15A

9. N. 03 - 15A Fuse

10. Fuses No. 04 - 15A

14. Fuses No. 08 - 7.5A

16. Fuses No. 10 - 7.5A

17. Fuses No. 11 - 7.5A

25. Horn 12v c.c.

26. Horn button

27. Pre-installation for anti-theft device

28. Ignition key contact

29. Max 12v-180w socket

30. Helmet compartment light switch

32. Instrument panel

36. Remote mode button

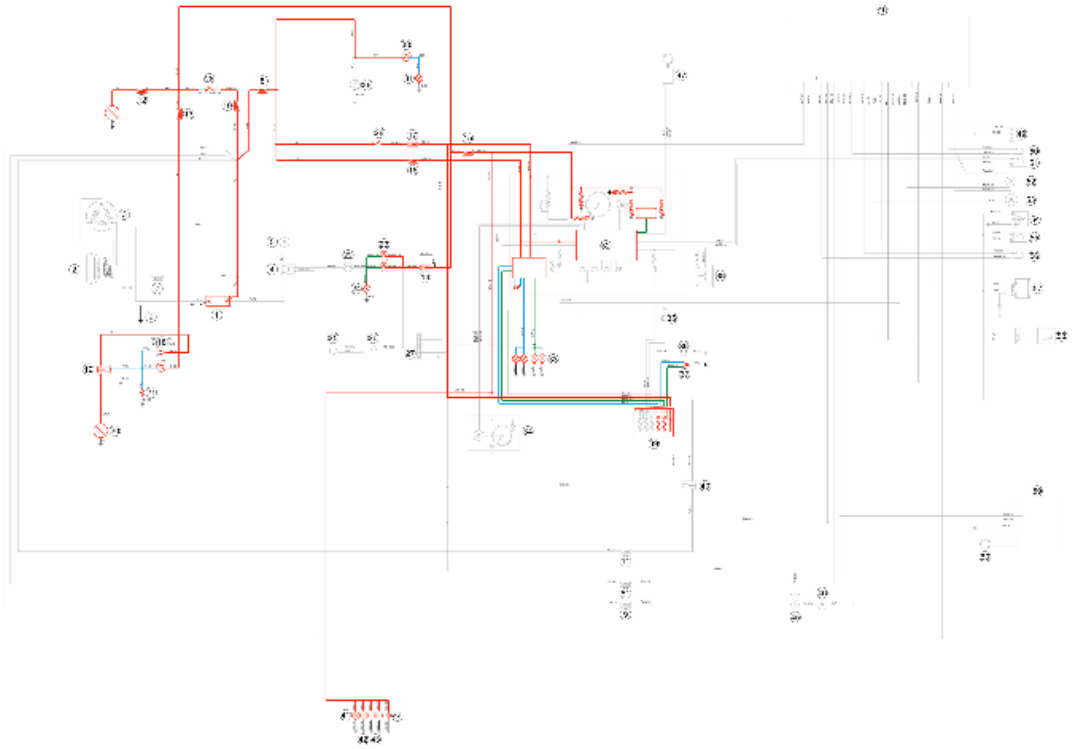
39. Electrical control device

45. Radiator electric fan remote control

46. Radiator electric fan

48. Injection ECU

Lights and turn indicators



KEY

1. Battery 12V - 14Ah

6. Engine ground

8. Fuses No. 02 - 15A

10. Fuses No. 04 - 15A

12. Fuses No. 06 - 7.5A

13. Fuses No. 07 - 7.5A

14. Fuses No. 08 - 7.5A

15. Fuses No. 09 - 7.5A

16. Fuses No. 10 - 7.5A

17. Fuses No. 11 - 7.5A

18. Light switch

19. High-beam light solenoid

20. High beam bulb 12v-55w

21. High beam warning light 12v-1.2w

23. N.2 stop buttons

24. Stop light bulb 12v-21/5w

28. Ignition key contact

30. Helmet compartment light switch

31. Helmet compartment lighting bulb 12v-5w

32. Instrument panel

33. Bulbs 12V-10W for turn indicators

37. Turn indicator switch

39. Electrical control device

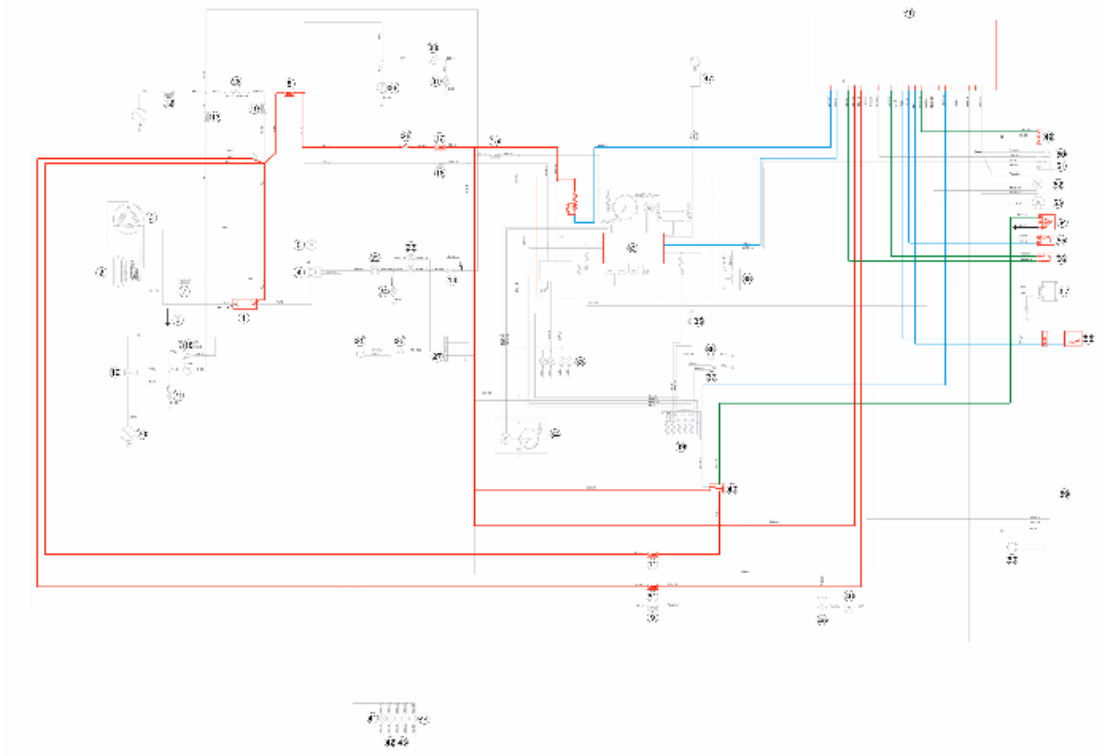
41. Rear daylight running light bulb 12v-21/5w

42. Bulb 12v-5w for license plate lamp

43. 2 bulbs 12v-5w for front daylight running light

44. Bulb 12v-1.2w for daylight running warning light

Injection



KEY

1. Battery 12V - 14Ah

6. Engine ground
8. Fuses No. 02 - 15A
11. Fuses No. 05 - 10A
17. Fuses No. 11 - 7.5A
28. Ignition key contact
32. Instrument panel
40. Electronic control unit remote control switch
48. Injection ECU
49. Diagnosis
54. Fuel pump
55. Fuel injector
56. Lambda sensor
58. Engine speed sensor
61. Fuses No. 12 - 7.5A

Checks and inspections

This section is dedicated to the checks on the electrical system components.

Immobiliser

The electronic ignition system is controlled by the control unit with the integrated Immobilizer system. The immobiliser is an antitheft system which allows the vehicle to function only if it is activated by means of the coded keys that the control unit recognises. The code is integrated in a transponder in the key block. This allows the driver clear operation without having to do anything other than just turning the key. The Immobilizer system consists of the following components:
- an electronic control unit
- immobilizer aerial
- master key with incorporated transponder (red key)
- service key with incorporated transponder (black key)
- HV coil
- diagnosis LED

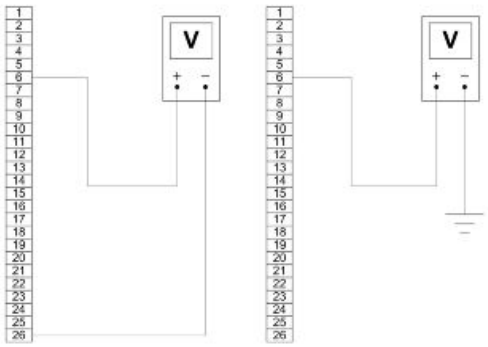
The diagnosis LED also works as a theft-deterrent blinker. This function is activated every time the ignition switch is turned to the "OFF" position, or the emergency stop switch is turned to the "OFF" position. It remains activated for 48 hours in order not to affect the battery charge. When the ignition switch is turned to the "ON" position, the theft-deterrent blinker function is deactivated. Subsequently, a flash confirms the switching to the "ON" status. The duration of the flash depends on the programming of the electronic control unit If the LED is off regardless of the position of the ignition-key switch and/or the instrument panel is not initiated, check if:

- there is battery voltage
- fuses 2, 5, 10, 11 are in working order
- there is power to the control unit as specified below:

Remove the connector mounting bracket shown in the photograph and disconnect the connector from the control unit. Check the following conditions:

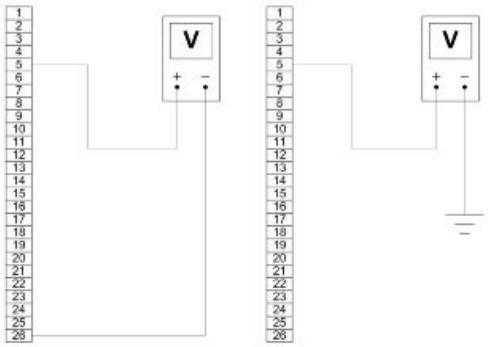
With the key switch set to OFF:

- if there is battery voltage between terminals 6-26 and terminal 6-chassis ground (fixed power supply). If there is no voltage check that fuse 12 and its cable are in working order.

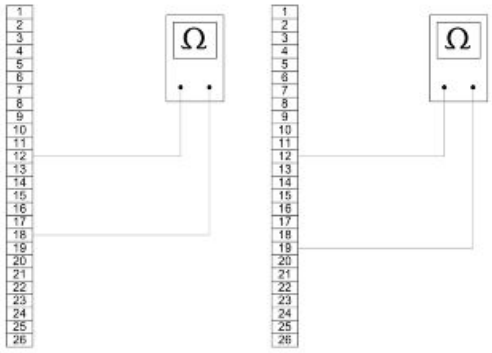


With the key switch in the ON position:

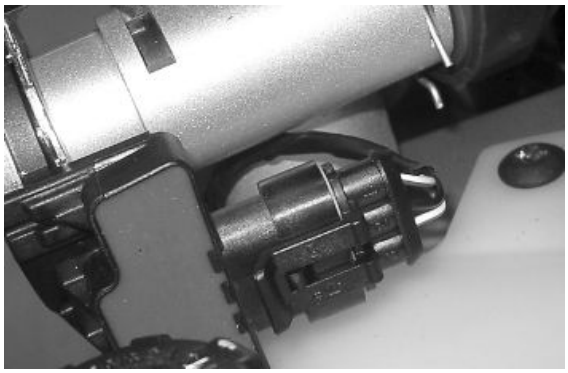
- there is battery voltage between terminals 5-26 and terminal 5-frame earth (fixed power supply). If there is no voltage, check the ignition switch contacts and that fuses No. 2, 11 and their cables are in working order.



- There is continuity between terminals 12-18 and the emergency cut-out switch is set to "RUN" and the side stand folded up. If there is no continuity, check the contacts of the latter.

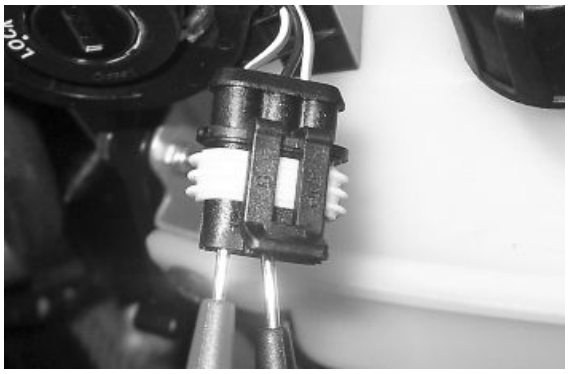


After removing the leg shield back plate, remove the electrical connection from the aerial as shown in the picture.



Remove the protective base from the connector.

With the ignition key switch set to ON, check if there is battery voltage between the White-Black and Black cables.

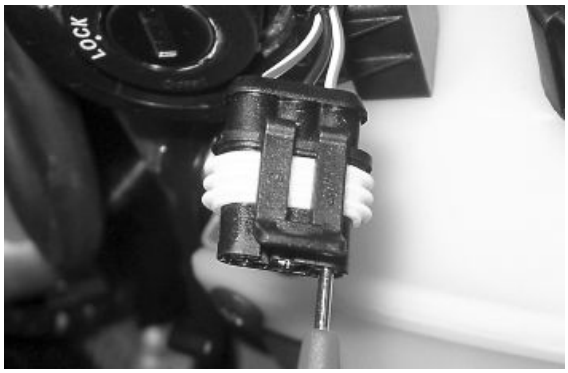


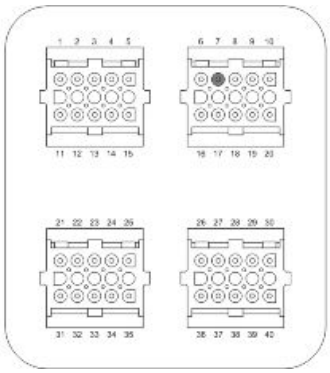
With MIU connector disconnected, check the continuity between the Orange-White cable and pin 7 of the interface wiring.

Specific tooling

020481Y Control unit interface wiring

020331Y Digital multimeter





Virgin circuit

When the ignition system is not encrypted, any key will start the engine but limited to 2000 rpm. The keys can only be recognised if the control unit has been programmed properly. The data storage procedure for a previously not programmed control unit provides for the recognition of the master as the first key to be stored to memory: this becomes particularly important because it is the only key that enables the control unit to be wiped clean and reprogrammed for the memorisation of the service keys.
The master and service keys must be used to code the system as follows:
- Insert the Master key, turn it to «ON» and keep this position for two seconds (limit values 1 to 3 seconds).
- Insert the service key and turn it to «ON» for 2 seconds.
- If you have copies of the key, repeat the operation with each key.
- Insert the MASTER key again and turn it to «ON» for 2 seconds.

The maximum time to change keys is 10 seconds.
A maximum of 7 service keys can be programmed at one time.
It is essential to adhere to the times and the procedure. If you do not, start again from the beginning.
Once the system has been programmed, the master key transponder is strictly matched with the control unit. With this link established, it is now possible to encode new service keys, in the event of losses, replacements, etc. Each new programming deletes the previous one so, in order to add or eliminate keys, you must repeat the procedure using all the keys you intend to keep using. If a service key becomes uncoded, the efficiency of the high voltage circuit shielding must be thoroughly inspected: In any case it is advisable to use resistive spark plugs.

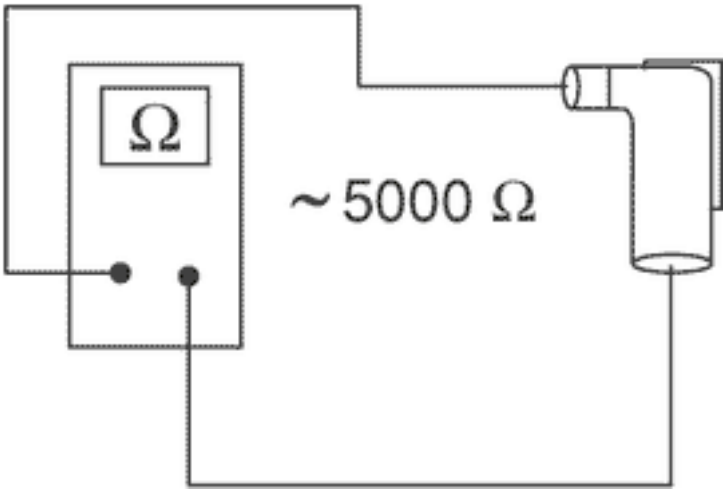
Characteristic

MASTER key:

RED KEY

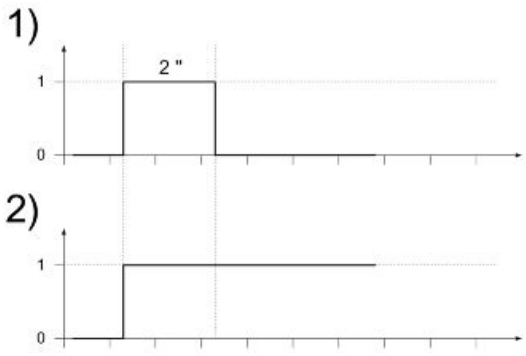
SERVICE key.

BLACK KEY



Diagnostic codes

The Immobilizer system is tested each time the ignition key is turned from «OFF» to «ON». During this diagnosis phase a number of control unit statuses can be identified and various light codes displayed. Regardless of the code transmitted, if at the end of the diagnosis the LED remains off permanently, the ignition is enabled. If, however, the LED remains on permanently, it means the ignition is inhibited:

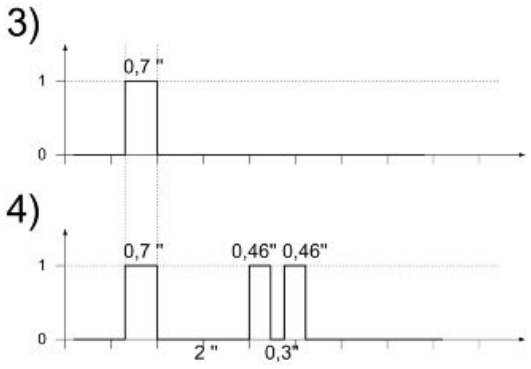


1. Previously unused control unit - key inserted: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the vehicle can be started but with a limitation imposed on the number of revs.

2. Previously unused control unit - transponder absent or cannot be used: the LED is on permanently. In this condition no operations are possible including the start up of the vehicle.

3. **Programmed control unit - the service key in (normal condition of use)**: a single 0.7-second flash is displayed, after which the LED remains off steadily. The engine can be started.

4. **Programmed control unit - Master key in**: a 0.7-sec flash is displayed followed by the LED remaining off for 2 sec and then by short 0.46-sec flashes, the same number of times as there are keys stored in the memory including the Master key. When the diagnosis has been completed, the LED remains permanently OFF. The engine can be started.

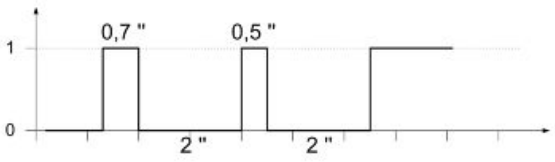


5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on steadily. The engine cannot be started. The codes that can be transmitted are:

- 1-flash code
- 2-flash code
- 3-flash code

Diagnostic code - 1 flash

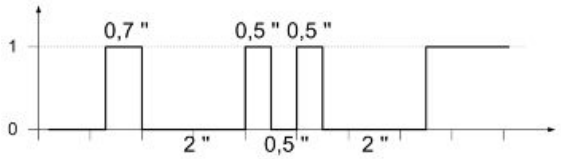
A one-flash code indicates a system where the serial line is not present or is not detected. Check the Immobilizer aerial wiring and change it if necessary.



Diagnostic code - 2 flashes

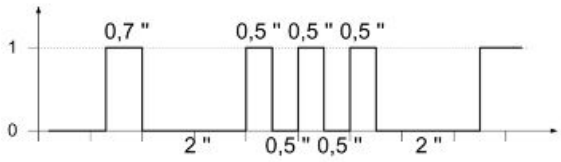
A two-flash code shows a system where the control unit does not show the transponder signal. This might depend on the inefficiency of the immobiliser aerial or the transponder.

Turn the switch to ON using several keys: if the code is repeated even with the Master key, check the aerial wiring and change it if necessary. If this is not the case, replace the defective key and/or reprogram the control unit. Replace the control unit if the problem continues.



Diagnostic code - 3 flashes

A three-flash code indicates a system where the control unit does not recognise the key. Turn the switch to ON using several keys: if the error code is repeated even with the Master key, replace the control unit. If this is not the case, reprogram the decoder.



Ignition circuit

No spark plug

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

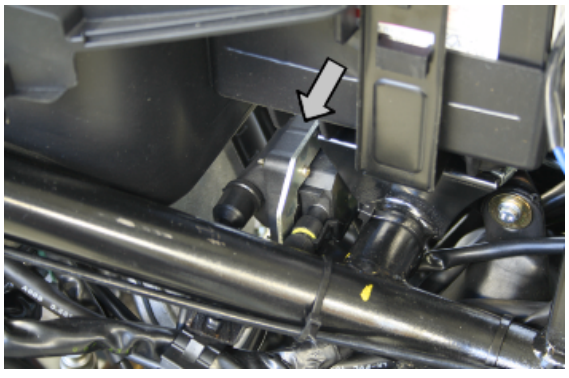
HV coil primary resistance value:

Disconnect the connector of the HV coil and measure the resistance between the two terminals.

Characteristic

HV coil resistance primary value:

~ 0.9 Ω

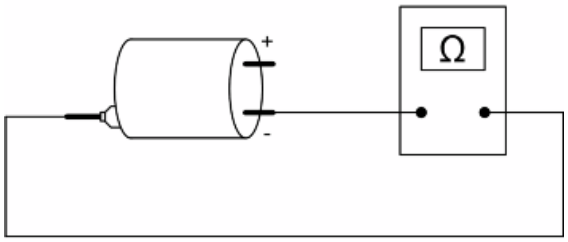


HV coil secondary resistance value:

1) Disconnect the HV cable from the spark plug and measure the resistance between the spark plug cap and the HV coil negative terminal.

2)Disconnect the spark plug cap from the HV cable and measure the resistance between the HV cable end and the HV coil negative terminal (see figure).

3) Measure the resistance between the 2 ends of the spark plug cap.



Characteristic

HV coil secondary resistance value with spark plug cap

~ 8.4 kΩ

HV coil secondary resistance value:

~ 3.4 kΩ

Spark plug cap resistance value

~ 5 kΩ

Battery recharge circuit

The charging circuit consists of three-phase alternator and a permanent magneto flywheel.

The generator is directly connected to the voltage regulator.

In turn, the voltage regulator is directly connected to the ground connection and to the battery positive terminal passing through the 30A protection fuse (No. 1).

The three-phase alternator provides good recharge power and at low revs a good compromise is achieved between generated power and idle stability.

Stator check

Checking the stator windings

WARNING

THIS CHECK-UP CAN BE MADE WITH THE STATOR PROPERLY INSTALLED.

1) Remove the central chassis cover.

2) Disconnect the connectors between stator and regulator with the three yellow cables.

3) Measure the resistance between each of the yellow terminals and the other two.

Electric characteristic

Resistance:

0.2 - 1 Ω

4) Check that there is insulation between the each yellow cable and the ground.

5) If values are incorrect, replace the stator.

Recharge system voltage check

Look for any leakage

1) Access the battery by removing its cover under the saddle.

2) Check that the battery does not show signs of losing fluid before checking the output voltage.

3) Turn the ignition key to position OFF, connect the terminals of the tester between the negative pole (-) of the battery and the black cable and only then disconnect the black cable from the negative pole (-) of the battery.

4) With the ignition key always at OFF, the reading indicated by the ammeter must be ≤ 0.5 mA.

Charging current check

WARNING

BEFORE CARRYING OUT THE CHECK, MAKE SURE THAT THE BATTERY IS IN GOOD WORKING ORDER.

1) Place the vehicle on its centre stand

2) With the battery correctly connected to the circuit, place the multimeter leads between the battery terminals..

3) Turn on the engine, increase the engine rpm and, at the same time, measure the voltage.

Electric characteristic

Voltage ranging between 14.0 and 15.0V at 5000 rpm.

Maximum current output check.

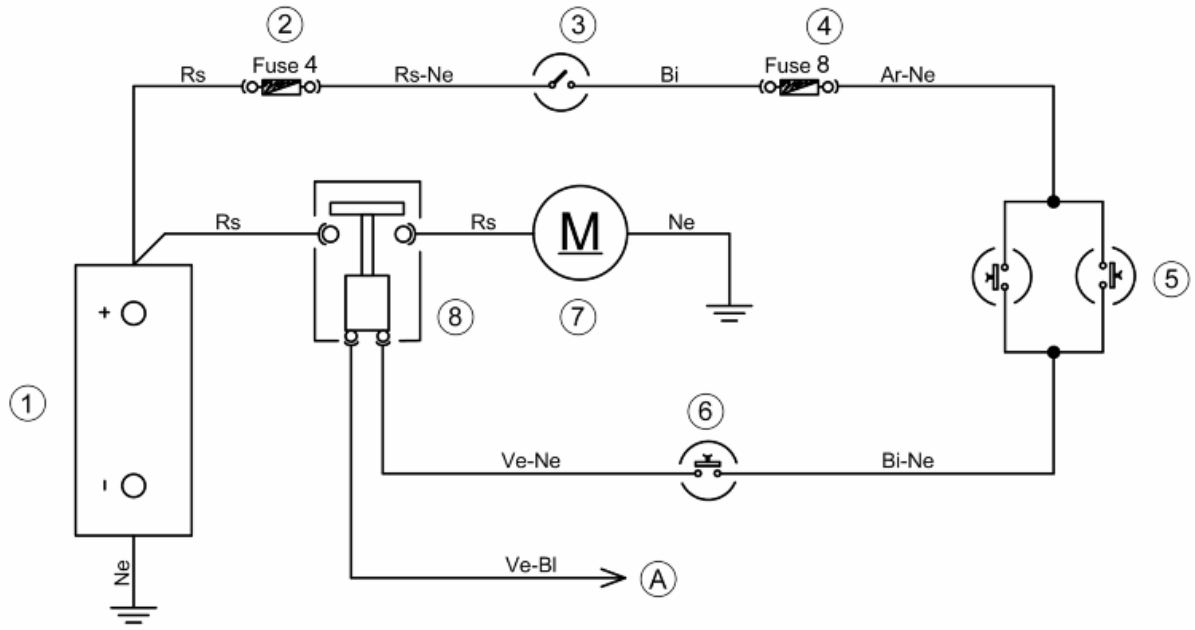
- With the engine off and the panel at «ON» with the lights on, allow the battery voltage to stop at 12V.
- Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
- Start the engine and rev it up to a high engine speed while reading the value on the pincer.

With an efficient battery a value must be detected: > 20A

VOLTAGE REGULATOR/RECTIFIER

Specification	Desc./Quantity
Type	Non-adjustable three-phase transistor
Voltage	14 to 15V at 5000 rpm with lights off

Start up system check



KEY

1. Battery

2. Fuse No. 4

3. ignition key contacts

4. Fuse No. 8

5. Stop buttons

6. Starter button

7. Starter motor

8. Starter solenoid

A. To the Injection ECU

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

1) Check fuses No. 4 and 8, and the key switch contacts.

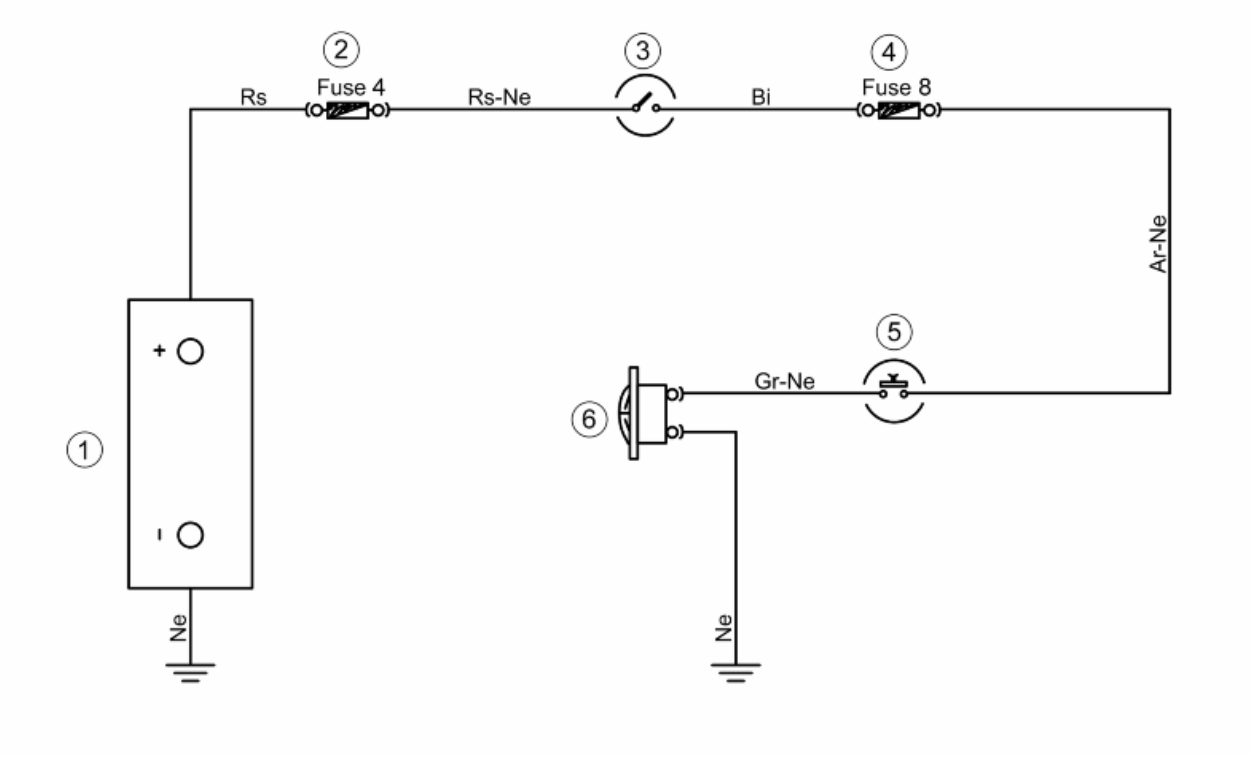
2) Check the contacts of the stop buttons and the starter button.

3) Check the start-up remote control switch.

4) Check wiring continuity between the Green-Blue cable that connects the starter remote control to the injection electronic control unit (pin 24).

5) Check the starter motor ground connection.

Horn control



KEY

1. Battery

2. Fuse No. 4

3. ignition key contacts

4. Fuse No. 8

5. Horn button

6. Horn

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

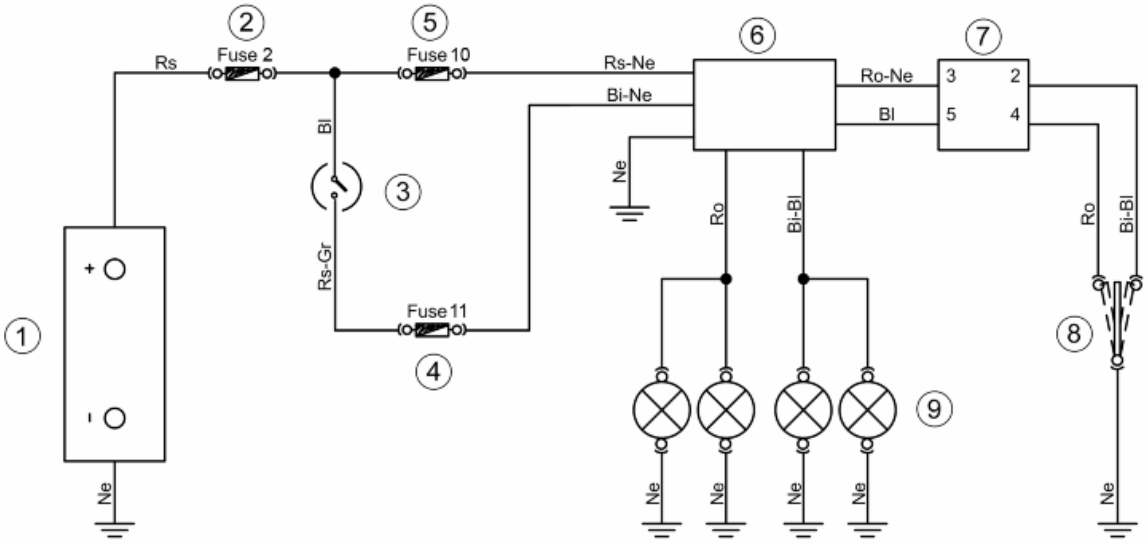
1) Check fuses No. 4 and 8, and the key switch contacts.

2) Check the horn button contacts.

3) Check wiring continuity.

4) Check the horn ground connection.

Turn signals system check



KEY

1.Battery

2. Fuse No. 2

3. ignition key contacts

4.Fuse No. 11

5. Fuse No. 10

6.Turn indicator control device

7.Electrical control device

8.Turn indicator switch

9.Bulbs for turn indicators

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

1) Check that bulbs operate properly.

2) Check fuses No. 2, 10, 11 and the key switch contacts.

3) Check if there is voltage between the Red-Black cable and the Black cable of the turn indicator control device or check wiring continuity.

3) With the key switch set to «**ON**», check again between the White-Black and the Black cables.

4) Check the turn indicator switch contacts.

5) Check continuity between the Red- Black cable (pin 3) and the White-Blue cable (pin 2) of the electric control device.

6) Repeat the check between the Blue cable (pin 5) and the Pink cable (pin 4).

7) Use the turn indicator control device to check bulb wiring continuity.

level indicators

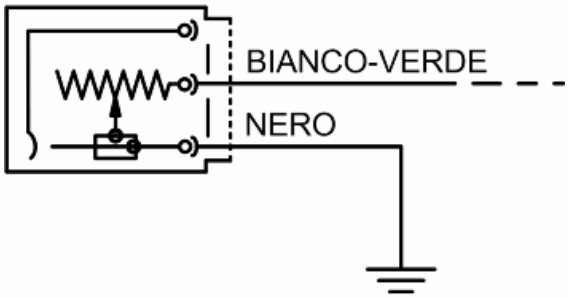
WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

If faults are detected:

1) With a multimeter, check resistance values between the White-Green cable and the Black cable of the fuel level transmitter under different conditions.

2) If the transmitter operates correctly but the indication on the instrument panel is not exact, check that the cable harnesses between them are not interrupted.



Electric characteristic

Resistance value when the tank is full

<= 7 Ω

Resistance value when the tank is empty

90 +13/-3 Ω

Lights list

BULBS

	Specification	Desc./Quantity
1	High/low beam light bulb	**Type**: Halogen (H7) **Power**: 12V - 55W **Quantity**: 2
2	Front headlights bulb	**Type:** Incandescent (W2.1 x 9.5 D) **Power:** 12V - 5W **Quantity:** 2
3	Rear turn indicator bulbs	**Type:** Incandescent (BAU 155) **Power:** 12V-10W **Quantity:** 2
4	Front turn indicator bulbs	**Type:** Incandescent (BAU 155) **Power:** 12V-10W **Quantity:** 2
5	Tail light and stop light bulb	**Type**: Incandescent (W2.1 x 9.5 D) **Power**: 12V - 21/5W **Quantity**: 1
6	License plate light bulb	**Type**: Incandescent (W2.1 x 9.5 D) **Power**: 12V - 5W **Quantity**: 1
7	Helmet compartment light bulb	**Type**: Incandescent (SV 8.5) **Power**: 12V - 5W **Quantity**: 1

Fuses

The electric system is fitted with 2 fuse boxes:

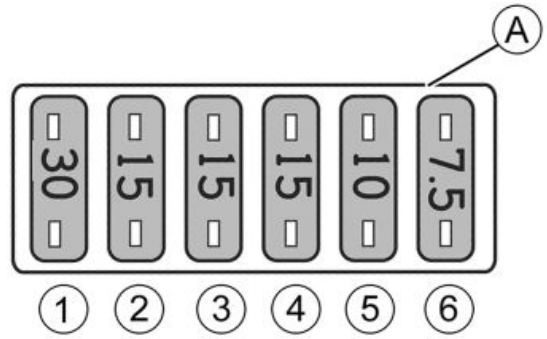
1. **Fuse box «A»** 6 fuses located in the helmet compartment near the battery.
2. **Fuse box «B»** 6 fuses located in the helmet compartment near the plug socket.

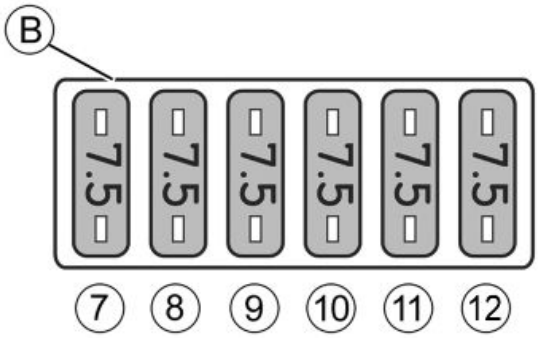
Replace fuses using adequate pliers supplied in the tool kit.

The chart shows the position and specifications of the fuses in the vehicle.

CAUTION

BEFORE REPLACING A BLOWN FUSE, FIND AND SOLVE THE FAILURE THAT CAUSED IT TO BLOW. NEVER TRY TO REPLACE THE FUSE WITH ANY OTHER MATERIAL (E.G., A PIECE OF ELECTRIC WIRE).





FUSES

	Specification	Desc./Quantity
1	Fuse no. 1	**Capacity:** 30 A **Protected circuits:** Battery recharge circuit.
2	Fuse no. 2	**Capacity:** 15 A

	Specification	Desc./Quantity
		Protected circuits: Lines protected by fuses No.10 and 11 (live), plug socket, helmet compartment lighting.
3	Fuse no. 3	**Capacity:** 15 A **Protected circuits:** Electric fan (via solenoid)
4	Fuse no. 4	**Capacity:** 15 A **Protected circuits:** Lines protected by fuses No. 6, 7, 8 and 9.
5	Fuse No. 5	**Capacity:** 10A **Protected circuits:** Injection load solenoid, h.v. coil, fuel injector, fuel pump.
6	Fuse No. 6	**Capacity:** 7.5A **Protected circuits (live):** Low beam headlight bulb.
7	Fuse No. 7	**Capacity:** 7.5A **Protected circuits (live):** High beam bulb, high beam light relay, high beam warning light.
8	Fuse No. 8	**Capacity:** 7.5A **Protected circuits (live):** Engine start up circuit, horn, stop light bulb.
9	Fuse No. 9	**Capacity:** 7.5A **Protected circuits (live):** Analogue rpm indicator, instrument panel lighting, daylight running light bulbs, license plate bulb, bulb for daylight running warning light.
10	Fuse No. 10	**Capacity:** 7.5A **Protected circuits:** Pre-installation for antitheft device, battery-powered instrument panel.
11	Fuse No. 11	**Capacity:** 7.5A **Protected circuits (live):** Instrument panel, turn indicator bulbs, radiator electrical fan remote control, electronic control unit relay, decoder, antenna, immobilizer, ignition switched live for injection ECU, anti-theft device preparation.
12	Fuse No. 12	**Capacity:** 7.5A **Protected circuits:** Injection ECU battery power.

Dashboard

The digital display has two service symbols:

SERVICE:

The lamp should come on after reaching 1000 km, then every 10,000 km or 1 year after the last activation.

BELT:

This lamp should come on and flash every 10,000 km.

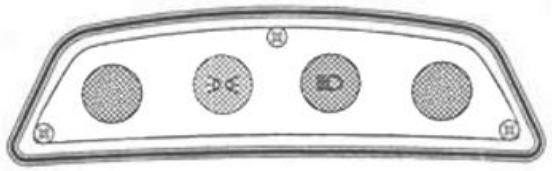
- Press buttons "MODE" and "ODO/SET" simultaneously at the moment you turn the key to "ON" for more than 3 seconds: The "BELT" symbol starts to flash.

- Pressing the button "MODE" for less than 1 second displays the symbols in turn. The selected symbol remains lit.
- Pressing button "MODE" for longer than 3 seconds resets the kilometre reading for the symbol selected, in "SERVICE" mode the date is also reset.

NOTE

- AT THE MOMENT THE DATE IS RESET, THE "SERVICE" SYMBOL IS ACTIVATED AGAIN.
- PERFORM THE RESET PROCEDURE ONLY AT THE MOMENT OF DELIVERY OF THE SCOOTER TO THE CUSTOMER IN ORDER THAT THIS SYMBOL SIGNALS THE NEED FOR THE FIRST SERVICE IN RELATION TO THE DISTANCE TRAVELLED AND THE TIME SINCE THE ACTIVATION.

The scooter has an instrument panel subdivided into 3 sections: Digital instrument with LCD and analogue speedometer, analogue rev counter and warning light group.



• **Warning light group**

The warning light group includes:

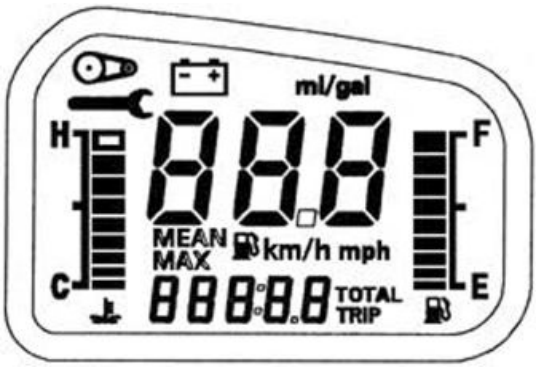
- Warning light preparation
- Tail light and low-beam warning light (green)
- High-beam warning light (blue)
- Warning light preparation

• **Digital instrument**

The digital section provides the displays of:

- Injection warning light (amber)
- Low fuel warning light (amber)
- Oil pressure warning light (red)
- Turn signal warning light (green)
- Immobilizer LED (red)

The digital section of the instrument panel is completed by a liquid crystal display and 3 control buttons (MODE - CLOCK - ODO/SET).



- The LCD panel provides a 5-digit display for the visualisation of:

• Total kilometres

• Trip kilometres

• Clock

NOTE

IT IS POSSIBLE TO CHANGE THE DISPLAY TO KM OR MILES BY PRESSING THE BUTTONS "MODE" AND "CLOCK" SIMULTANEOUSLY FOR LONGER THAN 3 SECONDS AT THE MOMENT YOU TURN THE KEY TO POSITION "ON". THE WORD "SET" WILL BE DISPLAYED.

- Pushing the "MODE" button for less than a second displays the following function sequence:

1. **Average speed**

The word "MEAN" appears together with km/h or mph.

The value is calculated on the basis of the trip kilometre reading.

2. **Maximum speed**

The word "MAX" appears together with km/h or mph.

The value is calculated on the basis of the trip kilometre reading.

3. **Average consumption**

The fuel symbol, the word "MEAN" and km/h or mph appear.

The value is calculated on the basis of the trip kilometre reading.

4. **Momentary consumption**

The fuel symbol and km/h or mph appear.

5. **Range**

The fuel icon appears.

If the range drops below 40 km, the symbol appears automatically and flashes for 60 seconds.

When the low fuel warning light comes on permanently, dashes appear instead of the range value.

6. **Battery voltage**

The battery symbol appears

Pressing button "MODE" for longer than 3 seconds returns you to function "1" of the sequence (average speed).

- The display also contains the symbols:

BELT:

Indicates the need to replace the transmission belt.

This lamp should come on and flash every 10,000 km.

SERVICE:

Indicates the need to carry out the scheduled maintenance operations.

The lamp should come on after reaching 1000 km or 1 year after initial activation, then every 10,000 km or 1 year after the last activation.

WARNING

THE SCOOTER SHOULD BE SERVICED IN ANY CASE AT THE KILOMETRE INTERVALS INDICATED IN THE OPERATING AND MAINTENANCE MANUAL; DO NOT RELY ON THE SERVICE DISPLAY THAT APPEARS ON THE INSTRUMENT PANEL.

Data check function

Setting the clock.

To set the clock, press the button "CLOCK" for more than 3 seconds.

The figures showing the hours start to flash.

Set the hours with the button "ODO/SET".

Press button "CLOCK" again and the figures showing the minutes start to flash.

Set the minutes with the «ODO/SET» button.

Press the «CLOCK» button again to start the clock moving normally.

During the reset process, not pressing any buttons for 8 seconds ends the process and the display will automatically show the modified time.

Setting the date.

Set the "DATE" using the "CLOCK".

If the button "CLOCK" is pressed for longer than 3 seconds, the figures showing the days start to flash.

Set the day with the «ODO/SET» button.

Press the "CLOCK" button again; the numbers showing the months start to flash.

Set the month with the "ODO/SET" button.

Press the "CLOCK" button again; the numbers showing the years start to flash.

Set the year with the "ODO/SET" button.

Press the «CLOCK» button again to start the clock moving normally.

During the reset process, not pressing any buttons for 8 seconds ends the process and the display will automatically show the modified date.

Sealed battery

Commissioning sealed batteries

If the vehicle is provided with a sealed battery, the only maintenance required is the check of its charge and recharging, if necessary.

These operations should be carried out before delivering the vehicle, and on a six-month basis while the vehicle is stored in open circuit.

Besides, upon pre-delivery it is therefore necessary to check the battery charge and recharge it, if required, before storing the vehicle and, afterwards, every six months.

INSTRUCTIONS FOR THE BATTERY REFRESH AFTER OPEN-CIRCUIT STORAGE

1) Voltage check

Before installing the battery on the vehicle, check the open circuit voltage with a regular tester.

- If voltage exceeds 12.60 V, the battery can be installed without any renewal recharge.
- If voltage is below 12.60 V, a renewal recharge is required as explained in 2).

2) Constant voltage battery charge mode

- Constant voltage charge equal to 14.40 ÷ 14.70V
-Initial charge voltage equal to 0.3 ÷ 0.5 for Nominal capacity
- Charge time:

10 to 12 h recommended

Minimum 6 h

Maximum 24 h

3) Constant current battery charge mode

-Charge current equal to 1/10 of the nominal capacity of the battery
- Charge time: 5 h

Specific tooling

020333Y Single battery charger

020334Y Multiple battery charger

Cleaning the battery

The battery should always be kept clean, especially on its top side, and the terminals should be coated with Vaseline.

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THAT RECOMMENDED. THE USE OF A FUSE OF UNSUITABLE CAPACITY MAY RESULT IN SERIOUS DAMAGES TO THE WHOLE VEHICLE OR EVEN CAUSE A FIRE.

CAUTION

CHARGE THE BATTERY BEFORE USE TO ENSURE OPTIMUM PERFORMANCE. FAILURE TO CHARGE THE BATTERY ADEQUATELY BEFORE BEING PUT INTO OPERATION WILL LEAD TO A PREMATURE FAILURE OF THE BATTERY.

If the scooter is not used for a given time (1 month or more) it will be necessary to periodically recharge the battery.

The battery runs down completely in the course of three months. If it is necessary to refit the battery in the vehicle, be careful not to reverse the connections, remembering that the ground wire (**black**) marked (-) must be connected to the **negative** clamp while the other two **red** wires marked (+) must be connected to the clamp marked with the + **positive** sign.

Dry-charge battery

COMMISSIONING A NEW DRY-CHARGED BATTERY

- Remove the battery air pipe stop cap and each single cell cap.
- Fill the battery with electrolyte of 1.270+/-0.01 kg/l density (corresponding to 31+/-1 Bé) with an ambient temperature not below 15°C, until it reaches the upper level indicated on the block.
- Tilt the battery slightly to remove any air bubbles formed during filling.
- Place the caps on each single cell filling hole without screwing them and leave the battery to rest. During this stage, the battery is subject to a gasification phenomenon and temperature increases.
- Let it rest until it reaches ambient temperature (this stage can take up to 60 minutes).
- Tilt the battery slightly to facilitate the elimination of any gas bubbles present inside; restore the level using the same filling electrolyte

Note: This is the last time that electrolyte can be added. Future top-ups should be done only with distilled water;

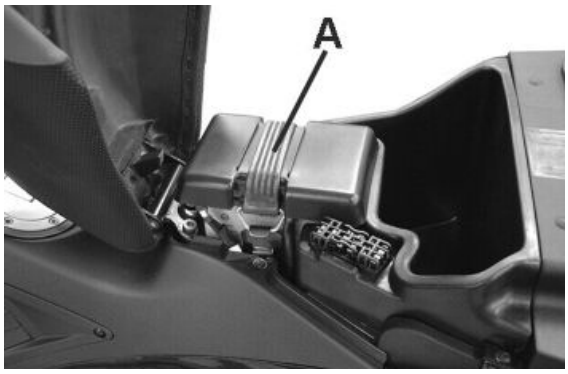
- Before 24 hours elapse, recharge the battery following these steps:
- Connect the battery charger terminals observing the correct polarity;
- Wit the battery charger drw. 020333Y and/or drw. 020334Y operate the battery charger control by selecting the position corresponding to that capacity;
- Otherwise, charge the battery with direct current equal to 1/10 of rated capacity (e.g. for a battery with a 9Ah rated capacity, the charging current should be 0.9-1.0A) for approximately a 4-6 hour charge.

Note: Batteries that have been stored for a long time may take a longer charging time. The battery chargers drw. 020333Y and drw. 020334Y have an automatic protection which interrupts the recharge after 12 hours to avoid battery harmful heating. In this case, a green LED turns on to indicate the activation of the safety system and not the end of the charge.

- Let the open circuit battery rest for approximately 4-6 hours; then check the off-load voltage using a standard tester.
- If the open-circuit voltage is higher or equal to **12.6V**, the battery is charged adequately. Slightly shake or tilt the battery to eliminate any air bubbles formed during recharging.
- Check the electrolyte levels again, fill them with distilled water up to the upper level line if necessary, clean battery properly, close each single cell cap tightly and install it on the vehicle.
- If the voltage indicated is low, charge the battery another 4-6 hours in the way described above.

Note: With the battery charger drw. 020334Y, it is possible to check the battery charge level with the **Check** function. The value indicated on the display must be higher than the value indicated on the chart; otherwise, recharge the battery again in the same way indicated above.

Battery installation



To access the battery, proceed as follows:

1. Place the scooter on its centre stand;
2. Open the saddle following above instructions, see «Saddle» section;
3. Remove the piston ring «**A**» and take off the battery cover.

The battery is the electrical device that requires the most frequent inspections and diligent maintenance. The most relevant maintenance rules to be observed are as follows:

Electric characteristic

Battery

12V-14Ah

- Insert the battery by connecting the battery breather tube as shown in the photograph.

NOTE

IN ORDER TO FIT THE CABLES ON THE BATTERY TERMINALS CORRECTLY, REST THE LOWER END OF THE TERMINAL SIDE OF THE BATTERY ON THE EDGE OF THE BATTERY WELL.

- Using the screwdriver, tighten up the battery terminal cables as far as they will go, placing the special Grover washer between the screw head and the cable terminal.

NOTE

DO NOT USE WRENCHES TO TIGHTEN UP THE SCREWS FOR FIXING THE TERMINALS TO THE BATTERY TERMINALS

- Refit the battery cover

Make sure that the terminals are connected correctly. When a new battery is installed, the correct time and date must be reset on the digital instrument panel («Clock» and «MODE button» section).

CAUTION

DO NOT REVERSE THE POLARITY: RISK OF SHORT CIRCUIT AND DAMAGE TO THE ELECTRICAL SYSTEM.

The electrolyte level, which should be checked regularly, must always be at the maximum level. To top it up to this level, **use only distilled water.** Should it become necessary to top up the battery with water

too frequently, check the scooter's electrical system because the battery is being overloaded, causing it to lose power quickly.

NEVER DISCONNECT THE BATTERY CABLES WHILE THE ENGINE IS RUNNING; THIS CAN CAUSE PERMANENT DAMAGE TO THE VEHICLE ELECTRONIC CONTROL UNIT.

CAUTION

ELECTROLYTE CONTAINS SULPHURIC ACID: AVOID CONTACT WITH EYES, SKIN AND CLOTHES. IN CASE OF ACCIDENTAL CONTACT, RINSE WITH ABUNDANT WATER AND CONSULT A DOCTOR.

WARNING

USED BATTERIES ARE HARMFUL FOR THE ENVIRONMENT. COLLECTION AND DISPOSAL SHOULD BE CARRIED OUT IN COMPLIANCE WITH REGULATIONS IN FORCE.

Phonic wheel

- Ensure that the tone wheel is correctly installed on the scooter and connected to the electrical system.
- Turn the key switch to "**ON**".
- Access the tone wheel connector on the **system side**.
- Carry out the following measurements using the special tool.

Specific tooling

020331Y Digital multimeter

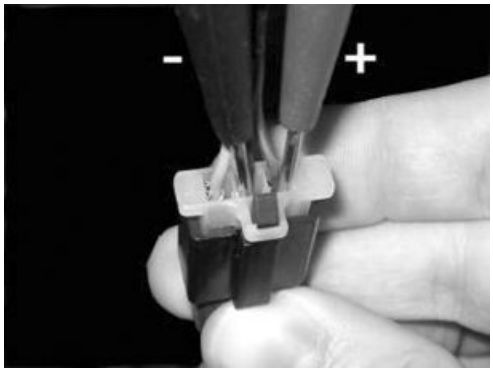
Check the supply voltage.

Keeping the connector in the position shown in the photo, check for battery voltage (12 V) with the polarity shown.

If incorrect values are measured, check the electrical system and the digital instrument.

NOTE

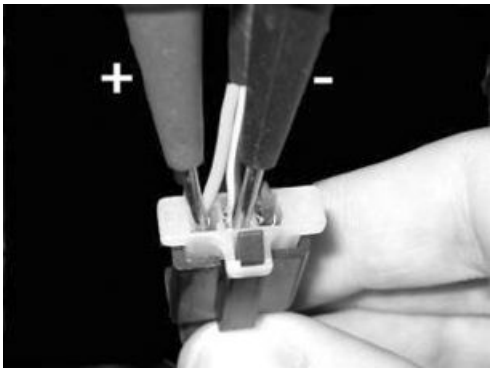
A DROP IN VOLTAGE OF 1 V IN RELATION TO THE BATTERY VOLTAGE CAN BE CONSIDERED NORMAL.



Check the signal

Move the positive rod to the position shown in the photo. Turn the front wheel very slowly and check that the measured voltage is 0 V or battery voltage, depending on the position taken up.

This condition should be repeated 16 times during a complete revolution of the wheel.



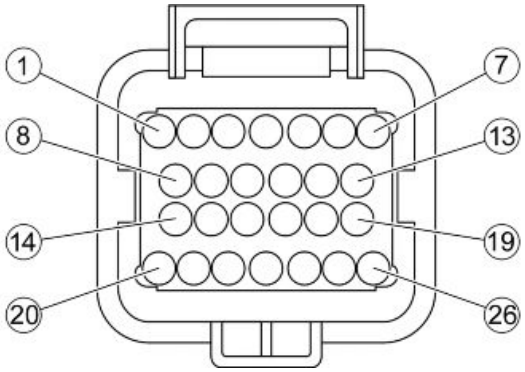
NOTE

THE DIGITAL MULTIMETER IS NOT ABLE TO DISPLAY THE VOLTAGE WHEN THE WHEEL IS ROTATED FAST.

If other voltages are measured or there is no alternation, replace the tone wheel.

Connectors

INJECTION ELECTRONIC CONTROL UNIT



1. Injection telltale light (Brown-Black)

2. Rpm indicator (Green)

3. Not connected

4 Lambda probe negative terminal (Sky blue-Black)

5 Live supply (White-Black)

6. Battery powered (White-Red)

7. Immobilizer aerial (Orange-White)

8. Electric fan remote control negative terminal (Green-White)

9. Engine temperature (Yellow-Pink)

10. Not connected

11. Lambda probe positive (Sky blue-Yellow)

12. Engine stop switch (Orange)

13. Pick-up positive terminal (Red)

14. Injector negative terminal (Red-Yellow)

15. Pick-up negative terminal (White)

16. K line (Orange-Black)

17. Immobilizer warning light (Grey-Yellow)

18. Stand button (Brown-Red)

19. Not connected

20. Injection load remote control negative terminal (Black-Purple)

21. Not connected

22. HV coil negative terminal (Pink-Black)

23. Not connected

24. Start-up enabling switch (Green-Blue)

25. Not connected

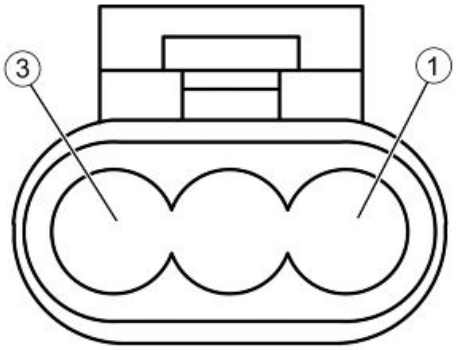
26. Ground (Black)

IMMOBILIZER AERIAL CONNECTOR

1. Live supply (White-Black)

2. Ground (Black)

3. Injection ECU (Orange-White)



ANTITHEFT DEVICE PRE-INSTALLATION CONNECTOR

1. LHS Turn indicator bulbs (Pink)

2. RHS Turn indicator bulbs (White-Blue)

3. Ground (Black)

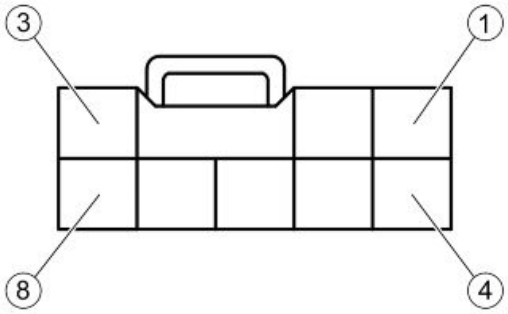
4. Battery powered (Red-Black)

5 Live supply (White-Black)

6. Helmet compartment light bulb (Blue-Yellow)

7. Not connected

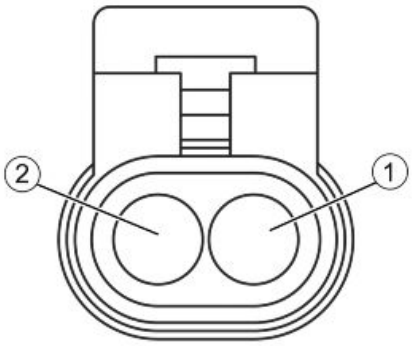
8. Not connected



LAMBDA PROBE CONNECTOR

1. Positive from injection ECU (Sky blue-Yellow)

2. Negative from injection ECU (Sky blue-Black)

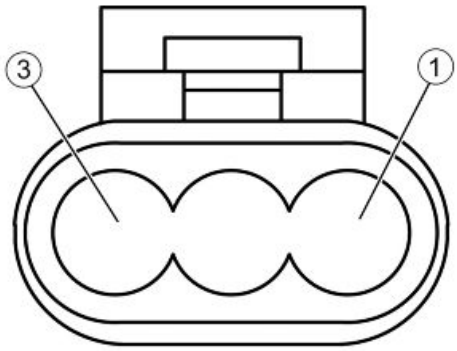


PICK-UP CONNECTOR

1. Positive from injection ECU (Red)

2. Negative from injection ECU (White)

3. Not connected



CONNECTOR FOR ELECTRICAL CONTROL MANAGEMENT DEVICE

1. Live supply (White-Black)

2. Right turn indicator switch (White-Blue)

3. LHS turn indicator signal (Blue)

4. LHS turn indicator switch (Pink)

5. RHS turn indicator signal (Pink-Black)

6. MODE button remote (Sky blue-Red)

7. MODE button remote signal (Grey)

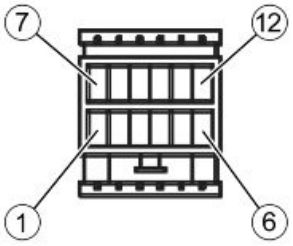
8. Oil pressure sensor (Pink-White)

9. Oil pressure sensor signal (White)

10. Not connected

11. Not connected

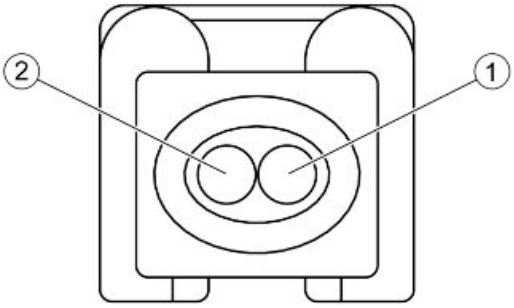
12. Not connected



FUEL INJECTOR CONNECTOR

1. Positive from remote control (Black-Green)

2. Negative from injection ECU (Red-Yellow)



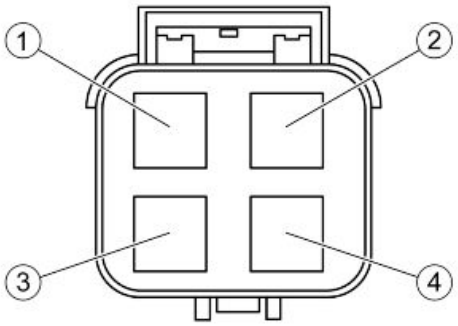
ENGINE TEMPERATURE SENSOR CONNECTOR

1. Injection ECU temperature signal (Yellow-Pink)

2. Indicator temperature signal (Orange)

3. Ground (Sky blue-Green)

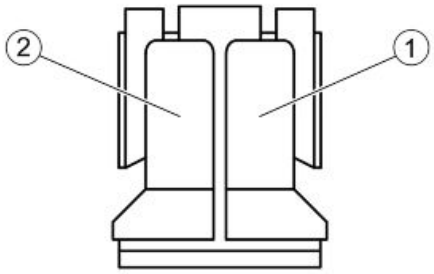
4. Indicator temperature signal (Sky blue-Black)



ELECTRIC FAN CONNECTOR

1. Ground (Black)

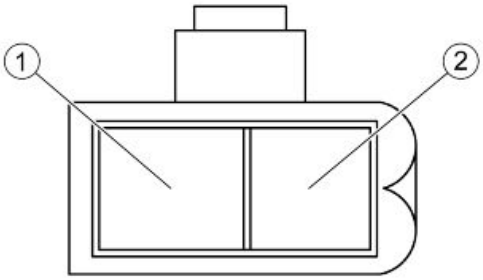
2. Positive from remote control (Red-Black)



STAND BUTTON CONNECTOR

1. Ground (Sky blue-Green)

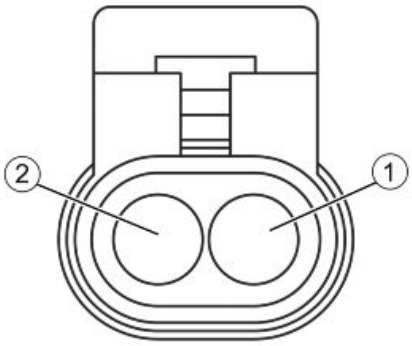
2. Injection ECU signal (Brown-Red)



HV COIL CONNECTOR

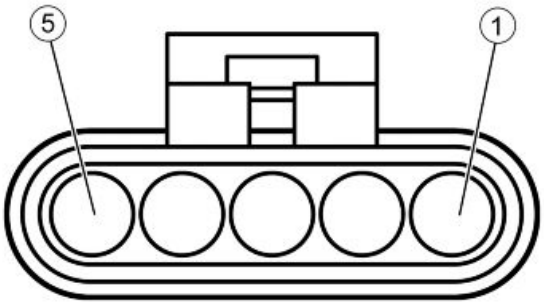
1. Positive from remote control (Black-Green)

2. Negative from injection ECU (Pink-Black)



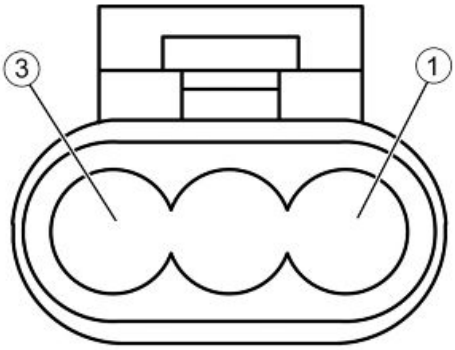
FUEL PUMP CONNECTOR AND FUEL LEVEL TRANSMITTER

1. Not connected
2. Ground (Black)
3. Ground (Black)
4. Fuel level indicator (White-Green)
5. Positive from remote control (Black-Green)



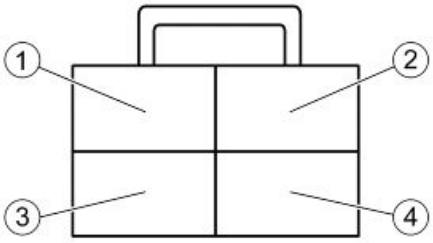
DIAGNOSIS CONNECTOR

1. Not connected
2. Ground (Black)
3. K line (Orange-Black)



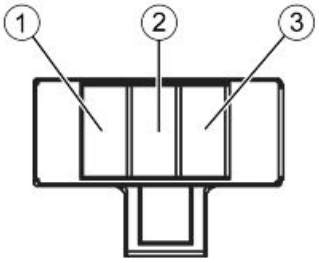
VOLTAGE REGULATOR CONNECTOR

1. Battery positive terminal (Red-White)
2. Ground lead (Black)
3. Battery positive terminal (Red-White)
4. Ground lead (Black)

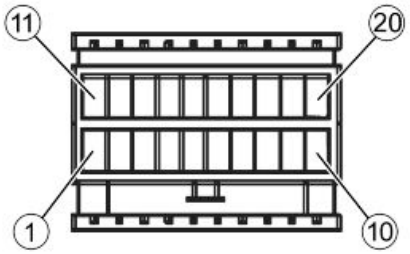


WHEEL TURNING SENSOR CONNECTOR

1. Indicator signal (Sky blue)
2. Indicator signal (Grey-Black)
3. Indicator signal (Red)

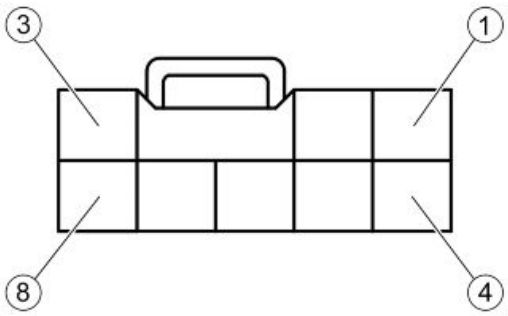


INSTRUMENT PANEL CONNECTOR



1. Wheel turning sensor signal (Red)
2. Wheel turning sensor signal (Sky blue)
3. Wheel turning sensor signal (Grey-Black)
4. Instrument panel lighting (Yellow-Black)
5. Rpm indicator (Green)
6. Engine temperature signal (Orange)
7. Engine temperature signal (Sky blue-Black)
8. Oil pressure sensor signal (White)
9. RHS Turn indicator bulbs (White-Blue)
10. LHS Turn indicator bulbs (Pink)
11. Battery powered (Red-Black)
12. Immobilizer warning light (Grey-Yellow)
13. Live supply (White-Black)
14. MODE button remote signal (Grey)
15. Fuel level indicator (White-Green)
16. Ground (Black)
17. Injection telltale light (Brown-Black)
18. LHS turn indicator signal (Blue)
19. RHS turn indicator signal (Pink-Black)
20. Not connected

WARNING LIGHT UNIT CONNECTOR



1. Not connected
2. Not connected
3. High-beam warning light (Purple)
4. Ground (Black)
5. Headlight warning light (Yellow-Black)
6. Not connected
7. Not connected
8. Not connected

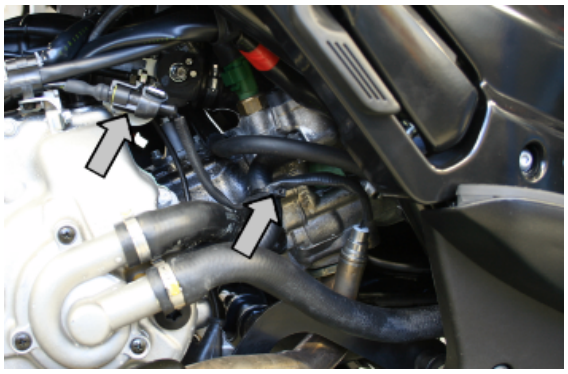
INDEX OF TOPICS

ENGINE FROM VEHICLE	ENG VE

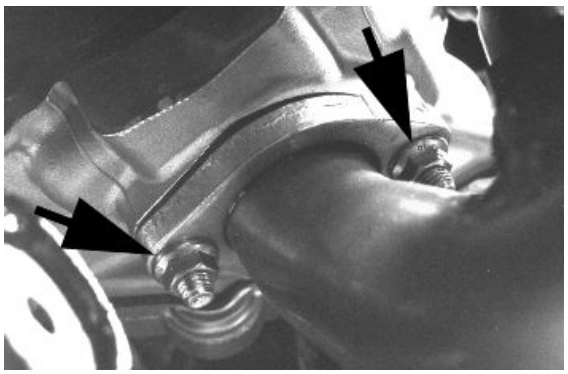
Questa sezione descrive le operazioni da effettuare per lo smontaggio del motore dal veicolo.

Exhaust assy. Removal

- Remove the Lambda probe from its support and disconnect it.
- Remove the retainer clamp.



- Undo the two exhaust manifold fixings on the head. To unscrew the nuts that fix the silencer flange to the head properly, use a jointed wrench that allows, according to the travel direction, to get also at the right nut. That is difficult to do with a traditional straight wrench.



- Undo the three screws that fix the silencer to the supporting arm.
- Remove the full silencer unit.

Remove the lambda probe from the manifold.

CAUTION: SHOULD IT BE NECESSARY TO REMOVE ONLY THE SILENCER TIP, ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN STUB AND TIP.

Removal of the engine from the vehicle

CAUTION

SUPPORT THE VEHICLE ADEQUATELY.

Disconnect the battery.

- Remove the side fairings.
- Remove the helmet compartment.

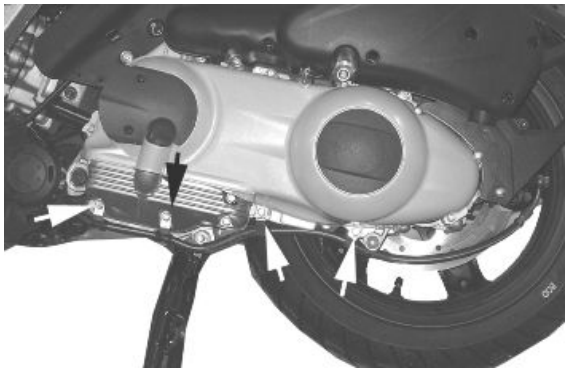
Remove the full muffler unit.

- Remove the air filter.
- Release the blow-by return pipe from the clamp and disconnect it from the head.

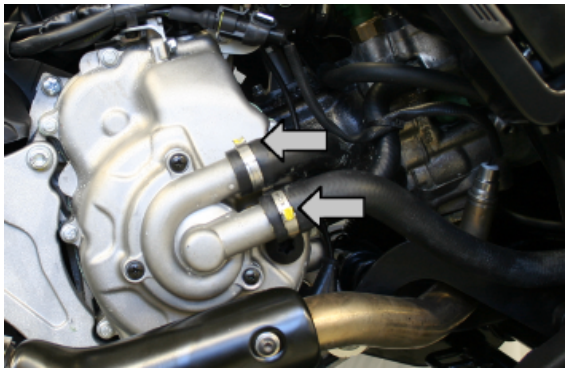
CAUTION

THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

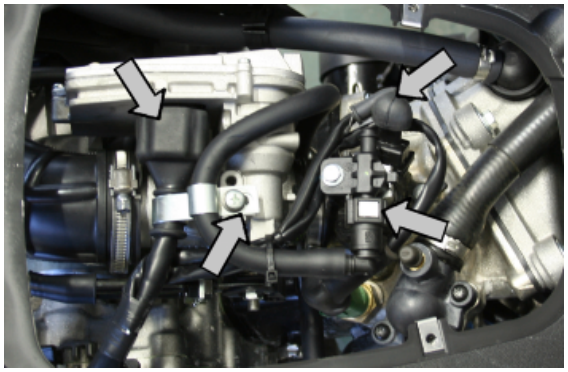
- Remove the rear brake calliper and release the rear brake piping from the four clamps of the engine.



- Get a + 2 l container in order to collect the coolant and place it under the vehicle.
- Remove the pipe that feeds coolant into the pump as shown in the picture and then empty the system.
- Remove the engine coolant outlet pipe as indicated.



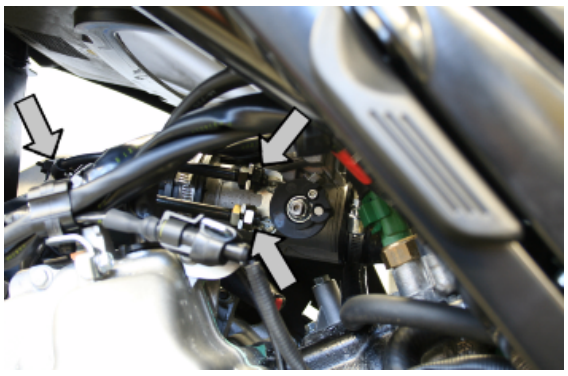
- Disconnect:
- fuel piping and retainer clamp.
- injector connector.
- control unit connector.



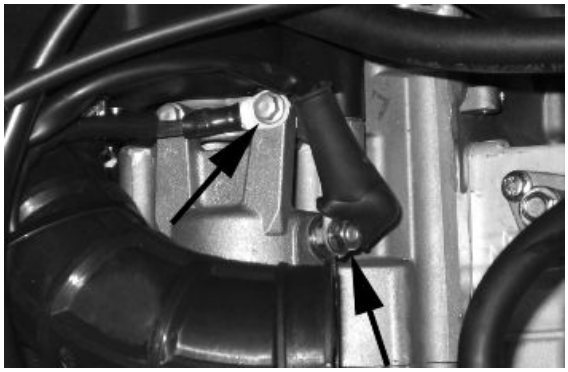
- Remove the coolant outlet pipe from the engine as indicated.

- Remove the spark plug cap.
- Remove the coolant temperature sensor connector indicated in the picture.

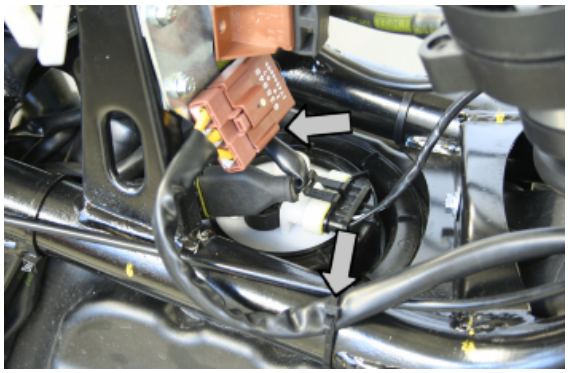
- Remove the throttle cables from the throttle body by undoing the nuts indicated in the photograph.
- Remove the throttle cable retainer clamp on the manifold.



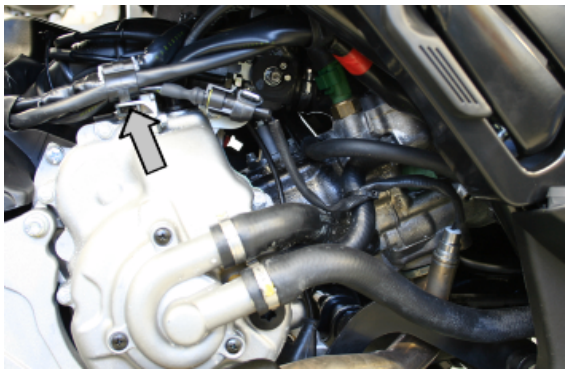
- Remove the positive and negative wiring from the starter motor as shown in the picture.



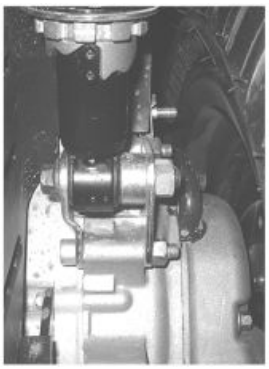
- Disconnect the flywheel wiring connector.
- Remove the clamp indicated.



- Remove the cables from the retainer clamps on the flywheel cover.

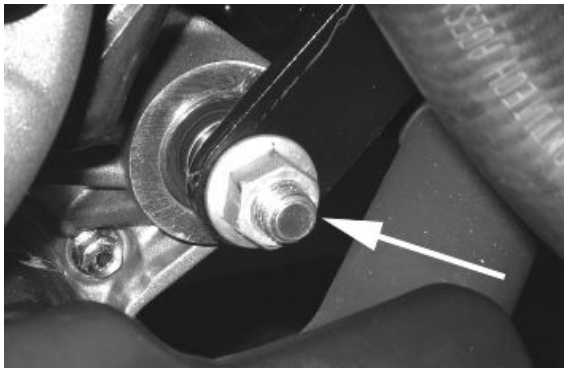


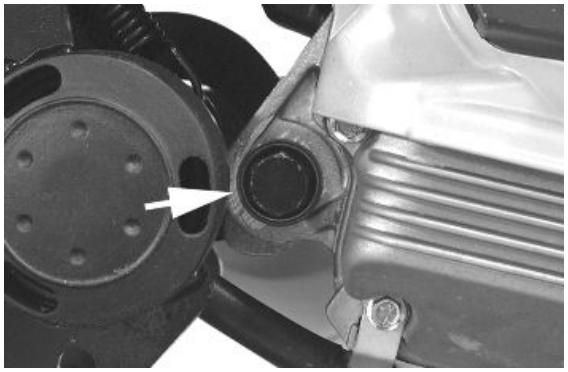
- Remove the lower screws of the right and left shock absorber.



When refitting the engine onto the vehicle, carry out the removal operations but in reverse order and respect the tightening torques shown in the Specifications Chapter.

- Check the engine oil level and if necessary, top it up with the recommended type.
- Fill and bleed the cooling circuit.
- Check accelerator and electric devices for correct functioning.



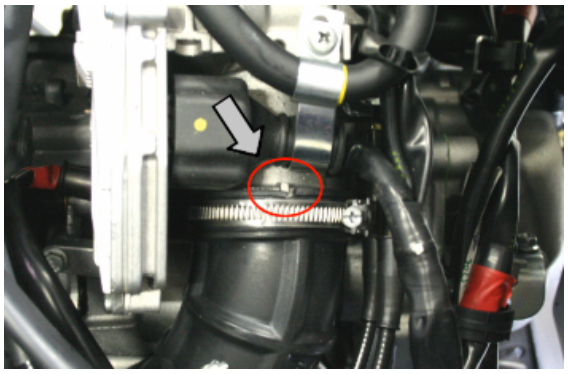


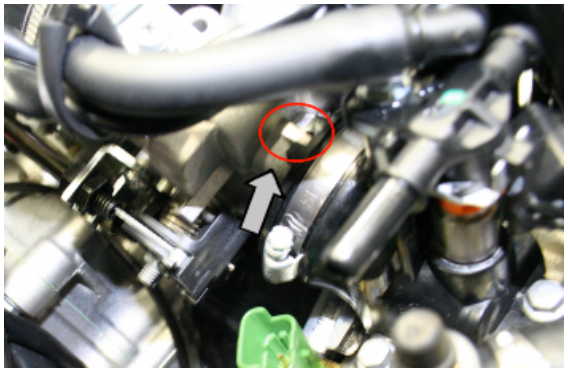
CAUTION

PAY PARTICULAR ATTENTION TO POSITIONING THE THROTTLE CONTROL TRANSMISSION PROPERLY.

Upon refitting the engine to the vehicle, carry out the removal operations but in reverse order, and respect the tightening torque shown in the «Specifications» Chapter.

- Check that there is a small clearance when the valve is in abutment against the set screw.
- Check the engine oil level and if necessary, top it up with the recommended type.
- Fill and bleed the cooling circuit.
- Check accelerator and electric devices for correct functioning.
- Pay particular attention to the sleeve, be careful to position the throttle body reference marks as indicated in the picture.





CAUTION

PAY PARTICULAR ATTENTION TO POSITIONING THE THROTTLE CONTROL TRANSMISSION PROPERLY.

INDEX OF TOPICS

ENGINE	ENG

This section describes the operations to be carried out on the engine and the tools to be used.

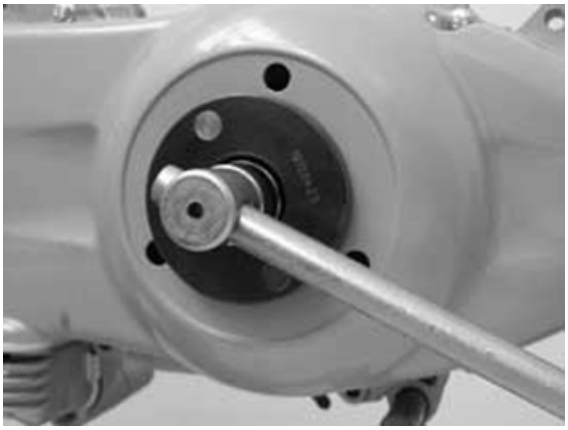
Automatic transmission

Transmission cover

- To remove the transmission cover it is necessary to remove the plastic cover first, by inserting a screwdriver in the slotted holes. Using the clutch housing lock wrench shown in the figure, remove the driven pulley shaft locking nut and washer.

Specific tooling

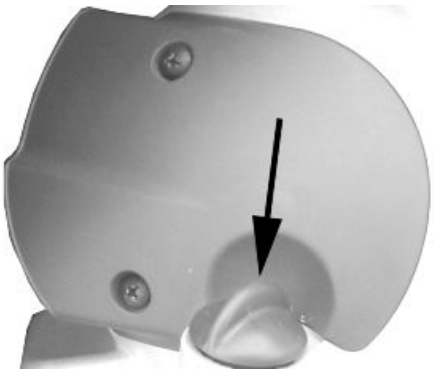
020423Y Driven pulley lock wrench



- Remove the cap/dipstick from the engine oil filling hole.
- Remove the ten screws.
- Remove the transmission cover.

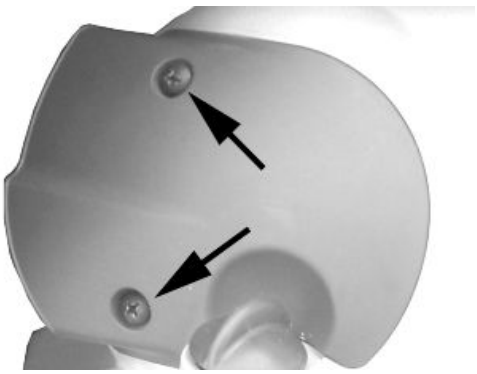
NOTE

WHEN YOU ARE REMOVING THE TRANSMISSION COVER YOU MUST BE CAREFUL NOT TO DROP THE CLUTCH HOUSING.

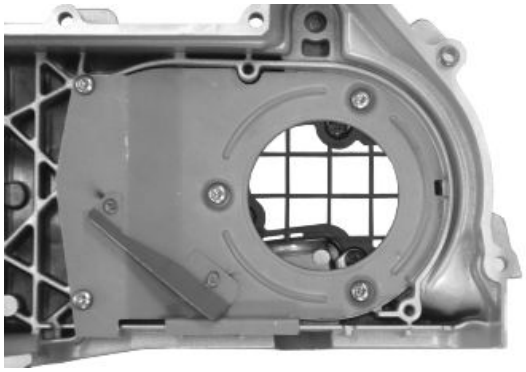


Air duct

- Remove the transmission compartment air intake cover shown in the picture.



- Remove the 5 screws, found on two different levels, as well as the small casing.



Removing the driven pulley shaft bearing

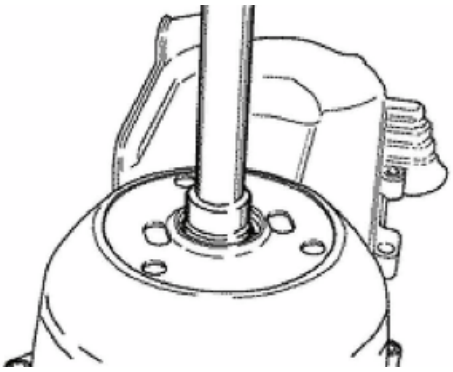
- Remove the clip from the inside of the cover.
- Remove the bearing from the crankcase by means of:

Specific tooling

020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020412Y 15-mm guide



Refitting the driven pulley shaft bearing

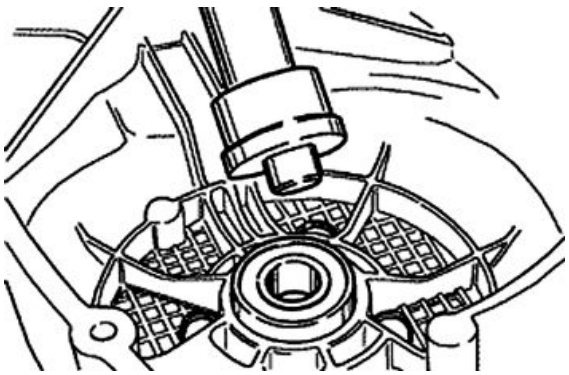
- Slightly heat the crankcase from the inside so as not to damage the painted surface.
- Insert the bearing in its seat.
- Refit the Seeger ring.

CAUTION

USE AN APPROPRIATE REST SURFACE TO AVOID DAMAGING THE COVER PAINT.

NOTE

ALWAYS REPLACE THE BEARING WITH A NEW ONE UPON REFITTING.



Specific tooling

020376Y Adapter handle

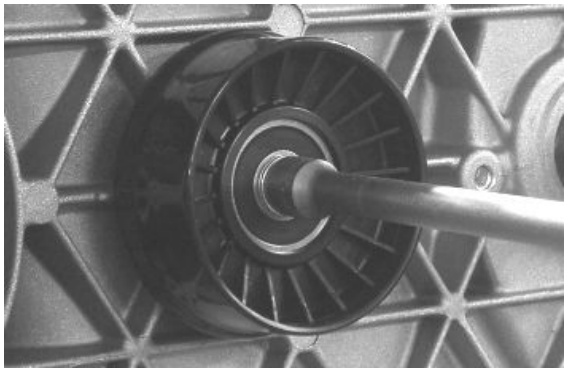
020357Y 32x35-mm Adaptor

020412Y 15-mm guide

Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Remove the special clamping screws as indicated in the photograph



- Check the outer diameter of the roller does not have defects that could jeopardise belt functioning
- For refitting, place the roller with the belt containment edge on the engine crankcase side
- Tighten the wrench to the prescribed torque.

Locking torques (N*m)

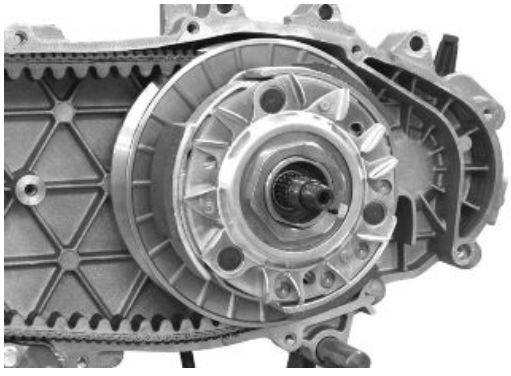
Anti-flapping roller 12 - 16

Removing the driven pulley

- Remove the clutch housing and the driven pulley assembly.

NOTE

THE UNIT CAN ALSO BE REMOVED WITH THE DRIVING PULLEY MOUNTED.



Inspecting the clutch drum

- Check that the clutch bell is not worn or damaged.
- Measure the clutch bell inside diameter.

Characteristic

Max. value clutch bell

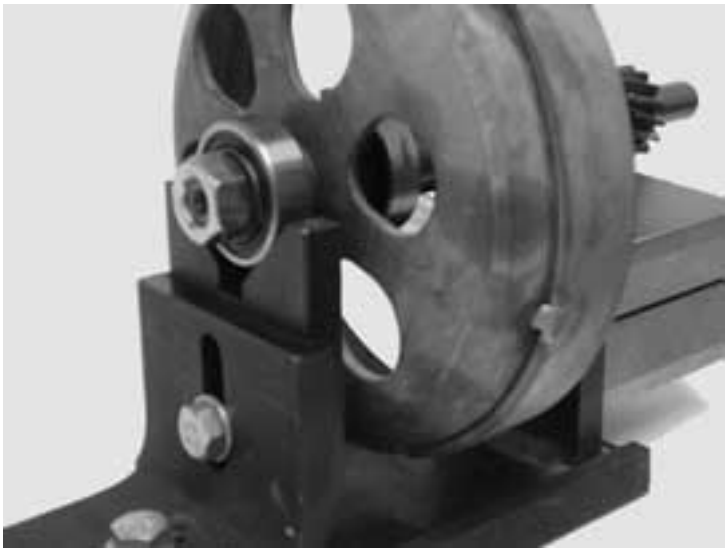
Max. value: Ø 134.5 mm

clutch housing standard value

Standard value: Ø 134 - 134.2 mm

Checking the bell working surface eccentricity

- Install the bell on a driven pulley shaft using 2 bearings (inside diameter: 15 and 17 mm).
- Lock with the original spacer and nut.
- Place the bell/shaft unit on the support to check the crankshaft alignment.



- Using a feeler dial gauge and the magnetic base, measure the bell eccentricity.
- Repeat the measurement in 3 positions (Central, internal, external).
- If faults are found, replace the bell.

Specific tooling

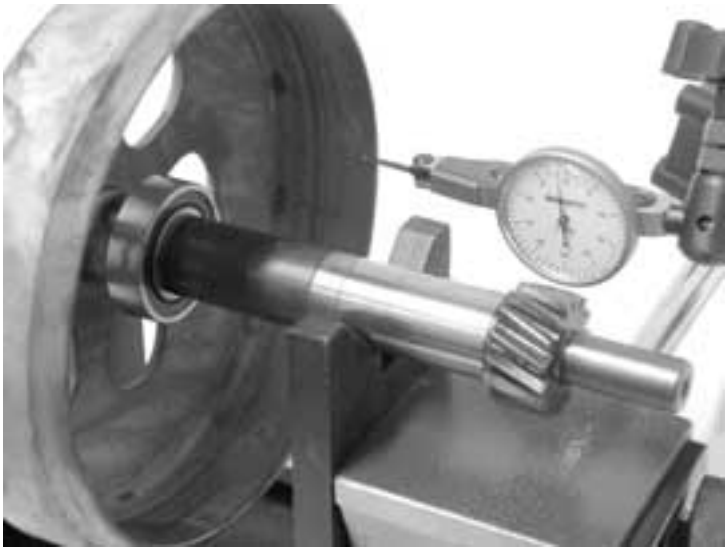
020074Y Support base for checking crankshaft alignment

020335Y Magnetic mounting for dial gauge

Characteristic

clutch bell inspection: Limit eccentricity.

Admissible limit eccentricity: 0.15 mm



Inspecting the clutch

- Check the thickness of the clutch mass friction material.

- The masses must not show traces of lubricants; otherwise, check the driven pulley unit seals.

NOTE

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL FAYING SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER.
VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

CAUTION

DO NOT OPEN THE MASSES USING TOOLS TO PREVENT A VARIATION IN THE RETURN SPRING LOAD.

Characteristic

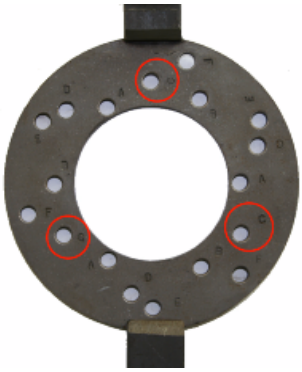
Check minimum thickness

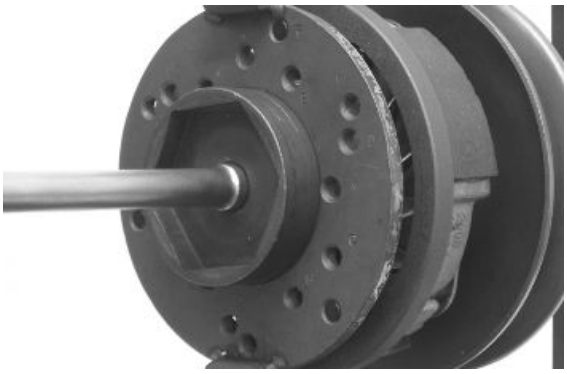
1 mm

Removing the clutch

Fit the driven pulley spring compressor specific tool with medium length pins screwed in position **«C»** on the tool internal side.

- Introduce the adapter ring 11 with the chamfering facing the inside of the tool.
- Fit the driven pulley unit on the tool with the insertion of the 3 pins in the ventilation holes in the mass holder support.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to loosen/tighten the clutch nut.
- Use the special 46x55 wrench component 9 to remove the nut fixing the clutch in place.
- Dismantle the driven pulley components (Clutch and spring with its plastic holder)





CAUTION

THE TOOL MUST BE FIRMLY FIXED IN THE CLAMP AND THE CENTRAL SCREW MUST BE BROUGHT INTO CONTACT WITH THE TOOL. EXCESSIVE TORQUE CAN CAUSE THE SPECIFIC TOOL TO BUCKLE.

Specific tooling

020444Y011 adapter ring

020444Y009 wrench 46 x 55

020444Y Tool for fitting/ removing the driven pulley clutch

Pin retaining collar

- Simultaneously turn and pull the collar manually to remove it.

NOTE

USE TWO SCREWDRIVERS IF YOU HAVE ANY DIFFICULTY.

NOTE

BE CAREFUL NOT TO PUSH THE SCREWDRIVERS IN TOO FAR TO AVOID DAMAGE THAT COULD COMPROMISE THE O-RING SEAL.

- Remove the 4 torque server pins and pull the pulley halves apart.

Removing the driven half-pulley bearing

- Check there are no signs of wear and/or noisiness; - Replace with a new one if there are.
- Remove the retainer ring using two flat blade screwdrivers.
- Support the pulley bushing adequately from the threaded side using a wooden surface.
- Using a hammer and pin, knock the ball bearing out as shown in the figure.

- Support the pulley properly using the bell as shown in the figure.

Specific tooling

001467Y035 Bell for 47-mm outside diameter bearings

- Remove the roller bearing using the modular punch.

Specific tooling

020376Y Adapter handle

020456Y Ø 24 mm adaptor

020363Y 20-mm guide

Inspecting the driven fixed half-pulley

- Measure the outside diameter of the pulley bushing.
- Check the faying surface with the belt to make sure there are no flaws.
- Check the riveted joints are functional.

- Check evenness of the belt contact surface.

Characteristic

Half-pulley minimum diameter

Minimum admissible diameter: Ø 40.96 mm

Half-pulley standard diameter

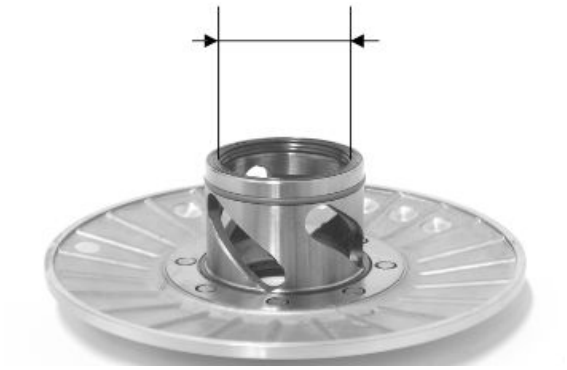
Standard diameter: Ø 40.985 mm

Wear limit

0.3 mm

Inspecting the driven sliding half-pulley

- Remove the two seal rings and the two O-rings.
- Measure the movable half-pulley bushing inside diameter.
- Check the faying surface with the belt to make sure there are no flaws.
- Check the riveted joints are functional.
- Check the evenness of the belt contact surface.



MOVABLE DRIVEN HALF-PULLEY DIMENSIONS

Specification	Desc./Quantity
Wear limit	0.3 mm
standard diameter	Ø 41.000 - 41.035 mm
maximum allowable diameter	Ø 41.08 mm

Refitting the driven half-pulley bearing

- Support the pulley bushing adequately from the threaded side using a wooden surface.
- Fit a new roller bearing as shown in the figure.
- For the fitting of the new ball bearing, follow the example in the figure using a modular punch.

Fit the retainer ring

WARNING

NOTE

FIT THE BALL BEARING WITH THE VISIBLE SHIELDING

Specific tooling

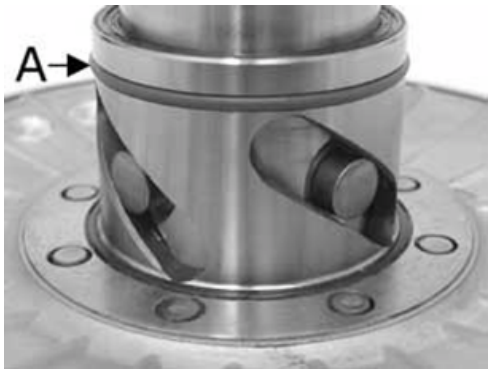
020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020424Y Driven pulley roller casing fitting punch

Refitting the driven pulley

- Insert the new oil seals and O-rings on the movable half-pulley.
- Lightly grease the O-rings «**A**» shown in the figure.
- Fit the half-pulley over the bushing using the specific tool.
- Check that the pins are not worn and proceed to refitting them in their slots.
- Refit the torque server closure collar.
- Using a curved-spout grease gun, lubricate the driven pulley unit with approximately 6 grams of grease. Apply grease through one of the holes in



the bushing until it comes out through the hole on the opposite side. This operation is necessary to avoid the presence of grease beyond the O-rings.

NOTE

THE TORQUE SERVER CAN BE GREASED WHETHER WITH BEARINGS FITTED OR WHEN THEY ARE BEING REPLACED; UNDERTAKING THE OPERATION WHEN THE BEARINGS ARE BEING SERVICED MIGHT BE EASIER.

Specific tooling

020263Y Driven pulley assembly sheath

Recommended products

AGIP GREASE SM 2 Gray black smooth-textured lithium grease, containing molybdenum disulphide.

-

Inspecting the clutch spring

- Measure the length of the spring when it is relaxed.

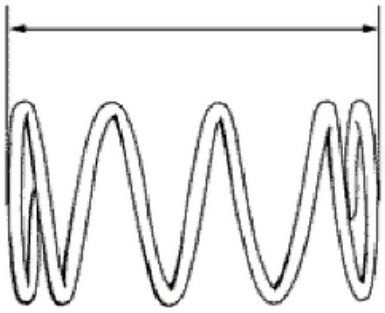
Characteristic

Standard length

123 mm

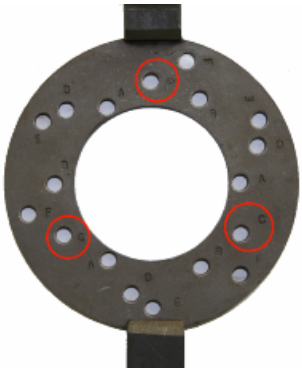
Acceptable limit after use:

118 mm

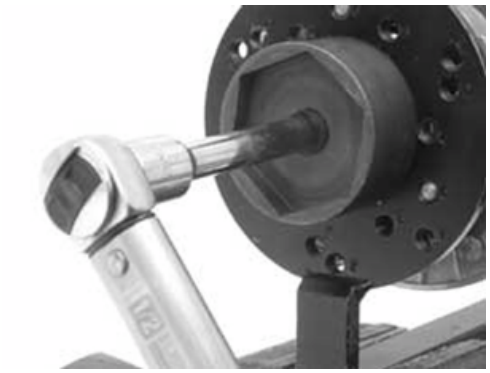


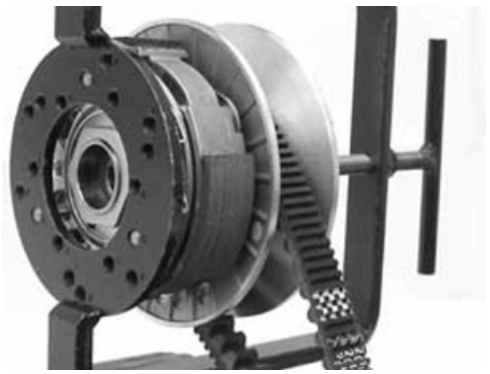
Refitting the clutch

- Support the driven pulley spring compressor specific tool with the control screw in vertical axis.
- Arrange the tool with the medium length pins screwed in position "**C**" on the inside.
- Introduce the adapter ring No. 11 with the chamfering facing upwards.
- Insert the clutch on the adapter ring.
- Lubricate the end of the spring that abuts against the torque server closing collar.



- Insert the spring with its plastic holder in contact with the clutch.
- Insert the drive belt into the pulley unit according to their direction of rotation.
- Insert the pulley unit with the belt into the tool.
- Slightly preload the spring.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to tighten the clutch nut.
- Place the tool in the clamp with the control screw on the horizontal axis.
- Fully preload the spring.
- Apply the clutch fixing nut and tighten it to the prescribed torque using the special 46x55 wrench.
- Loosen the tool clamp and insert the belt according to its direction of rotation.
- Lock the driven pulley again using the specific tool.
- Preload the clutch return spring with a traction/ rotation combined action and place the belt in the smaller diameter rolling position.
- Remove the driven pulley /belt unit from the tool.





NOTE

DURING THE SPRING PRELOADING PHASE, BE CAREFUL NOT TO DAMAGE THE PLASTIC SPRING STOP AND THE BUSHING THREADING.

NOTE

FOR DESIGN REASONS, THE NUT IS SLIGHTLY ASYMMETRIC; THE FLATTEST SURFACE SHOULD BE MOUNTED IN CONTACT WITH THE CLUTCH.

Specific tooling

020444Y Tool for fitting/ removing the driven pulley clutch

020444Y011 adapter ring

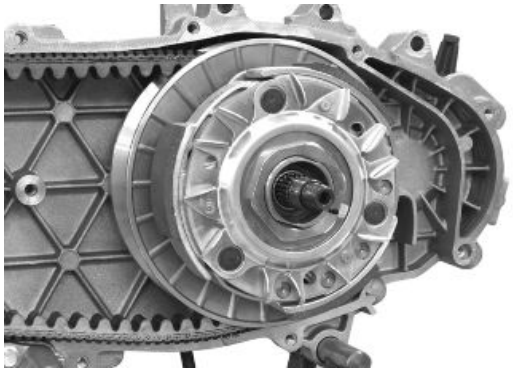
020444Y009 wrench 46 x 55

Locking torques (N*m)

Clutch unit nut on driven pulley **45 to 50**

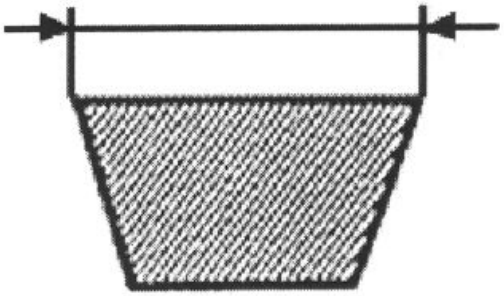
Refitting the driven pulley

- Refit the clutch bell.



Drive-belt

- Check that the driving belt is not damaged.
- Check the width of the belt.



Characteristic

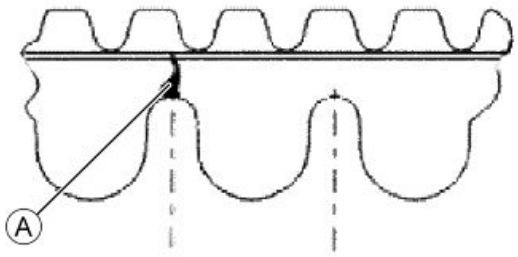
Driving belt - minimum width

19.5 mm

Driving belt - standard width

21.3 ± 0.2 mm

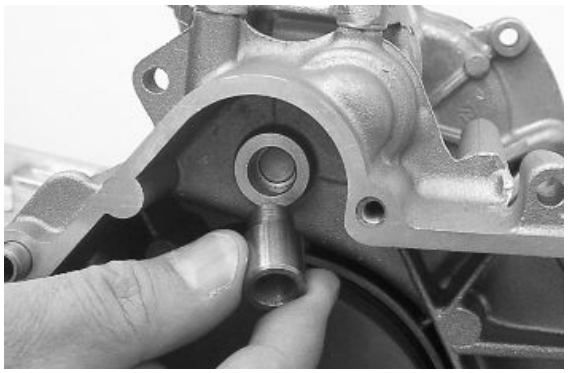
During the wear checks in foreseen in the scheduled maintenance program, you are advised to check that the rim bottom of the toothing does not show signs of incisions or cracking (see figure): The rim bottom of the tooth must not have incisions or cracking; if it does, change the belt.



Removing the driving pulley

- Turn the crankshaft until the ropes of the pulley are on a horizontal axis

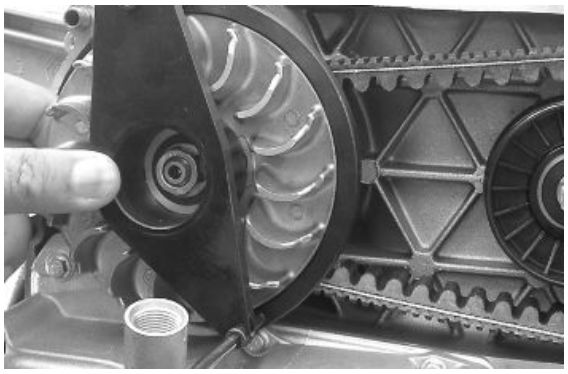
- Insert the adaptor sleeve of the appropriate tool in the hole shown in the picture



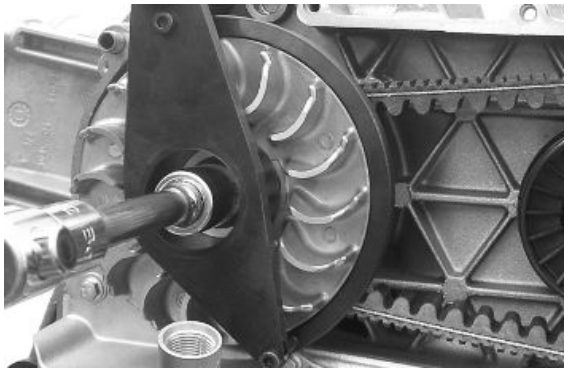
- Insert the tool in the hollows and apply the retention ring
- Bring in the ring's clamping screws while keeping the tool to support the pulley

Specific tooling

020626Y Driving pulley lock wrench



- Remove the fixing nut and the washer
- Remove the stationary drive pulley half.



Inspecting the rollers case

- Check that the internal bushing shown in the figure is not abnormally worn and measure inner diameter A.
- Measure outer diameter B of the pulley sliding bushing shown in the figure.
- Check that the rollers are not damaged or worn.
- Check the guide shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt faying surfaces on both pulley halves.
- Check that stationary driving pulley does not show signs of abnormal wear on the grooved edge and on the surface in contact with the belt.
- Check that the O-ring is not pushed out of shape.

CAUTION

DO NOT LUBRICATE OR CLEAN SINTERED BUSHINGS

Characteristic

movable driving half-pulley bushing: Standard Diameter

26.000 - 26.021 mm

movable driving half-pulley bushing: Maximum allowable diameter

Ø 26.12 mm

Sliding bushing: Standard Diameter

Ø 25.959 ÷ 25.98 mm

Sliding bushing: Minimum admissible diameter

Ø 25.95 mm

Roller: Standard Diameter

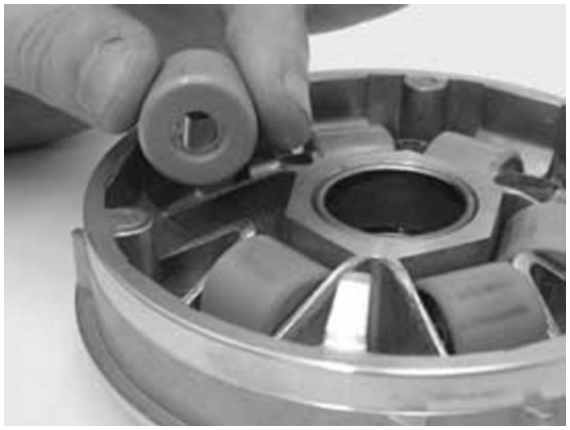
Diameter 20.5 - 20.7 mm

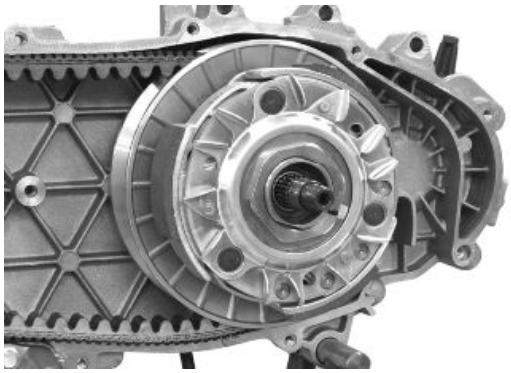
Roller: Minimum diameter permitted

Ø 20 mm

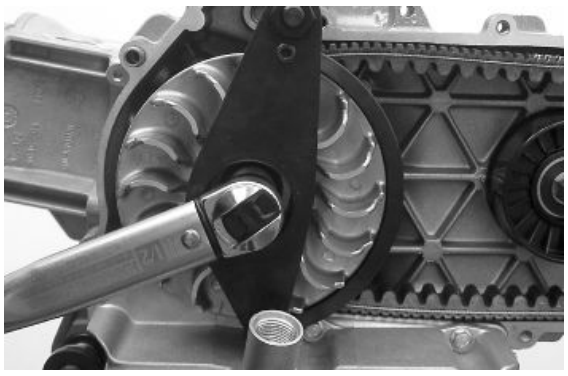
Refitting the driving pulley

- Preassemble the movable half-pulley with the roller contrast plate by putting the rollers in their housings with the larger support surface touching the pulley according to the direction of rotation.
- Check that the roller contact plate does not have flaws and is not damaged on the grooved edge.
- Mount the complete bushing unit on the crankshaft.
- Fit the driven pulley/Clutch/belt unit on the engine.





- Fit the steel shim in contact with the bushing and the stationary drive pulley.
- Install the appropriate tool as described in the removal phase.
-Tighten the nut with washer to the prescribed torque.



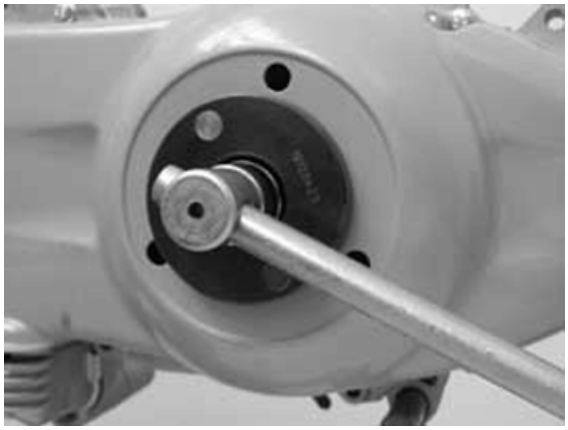
Specific tooling

020626Y Driving pulley lock wrench

Locking torques (N*m)

Drive pulley nut 75 - 83

Refitting the transmission cover



- Check that there are 2 alignment dowels and that the sealing gasket for the oil sump on the transmission cover is adequately fitted.
- Replace the cover and tighten the 10 screws to the specified torque.
- Refit the oil loading cap/bar.
- Refit the steel washer and the driven pulley nut.
- Tighten the nut to the prescribed torque using the lock wrench and the torque wrench tools.
- Refit the plastic cover.

Specific tooling

020423Y Driven pulley lock wrench

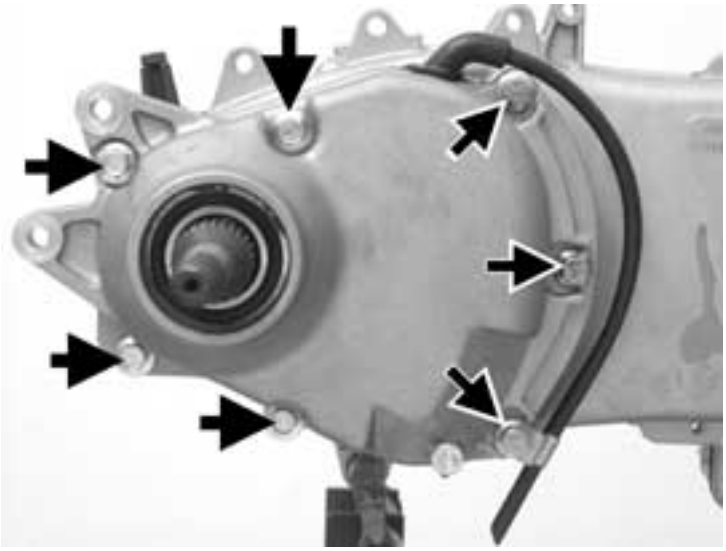
Locking torques (N*m)

Transmission cover screws 11 to 13 Driven pulley shaft nut 54 ÷ 60

End gear

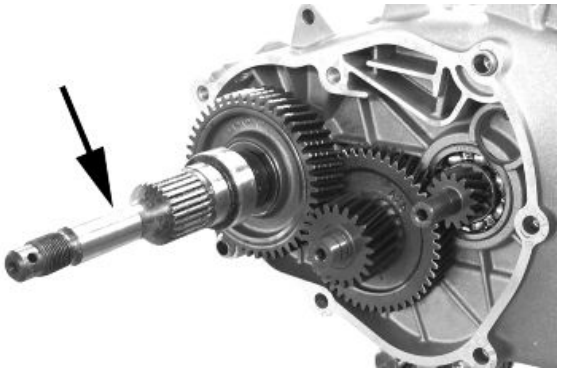
Removing the hub cover

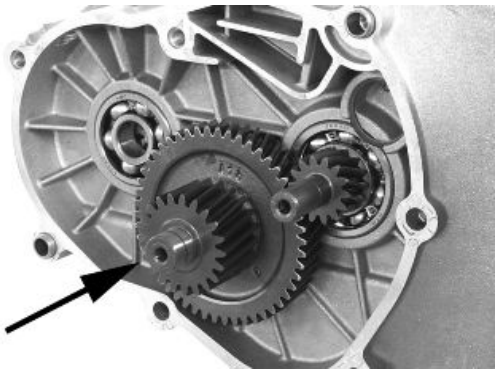
- Empty the rear hub through the oil drainage plug.
- Remove the 7 flanged screws indicated in the figure.
- Remove the hub cover and its gasket.



Removing the wheel axle

- Remove the wheel axis complete with gear.
- Remove the intermediate gear.





Removing the hub bearings

- Check the state of the bearings being examined (wear, clearance and noisiness). If faults are detected, do the following.
- Use the specific bearing extractor to remove the three 15 mm bearings (2 in the crankcase and 1 in the hub cover).

Specific tooling

001467Y013 Calliper to extract ø 15-mm bearings

Removing the wheel axle bearings

- Take out the clip on the outside of the hub cover.
- Support the hub cover and expel the bearing.

By means of the appropriate tools, remove the oil guard as in the figure.

Specific tooling

020376Y Adapter handle

020477Y 37 mm adaptor

020483Y 30 mm guide

020359Y 42 x 47-mm adaptor

020489Y Hub cover support stud bolt kit

Removing the driven pulley shaft bearing

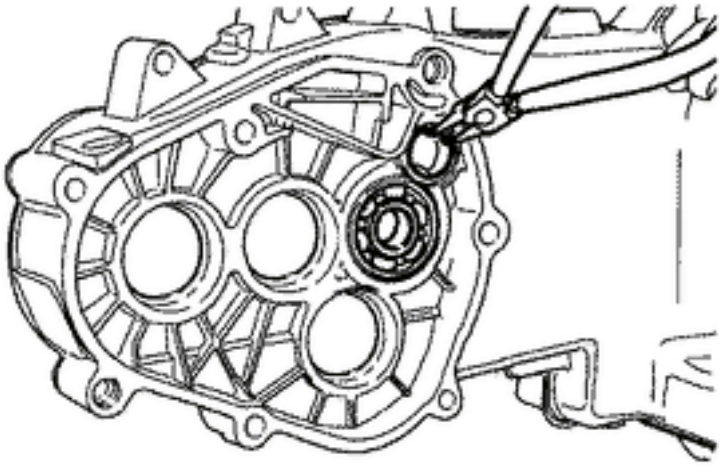
- As you need to remove the driven pulley shaft, its bearing and oil seal, remove the transmission cover as described above.
- Extract the driven pulley shaft from its bearing.
- Remove the oil seal using a screwdriver, working from inside the bearing and being careful not to damage the housing, make it come out of the belt transmission side.
- Remove the Seeger ring shown in the figure
- Remove the driven pulley shaft bearing using the modular punch.

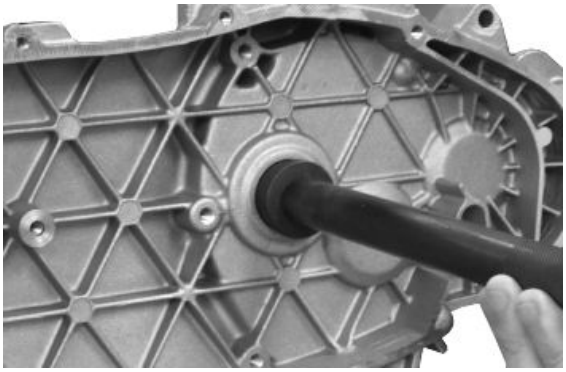
Specific tooling

020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020363Y 20-mm guide





Inspecting the hub shaft

- Check the three shafts for wear or distortion of the toothed surfaces, the bearing housings, and the oil seal housings.
- If faults are found, replace the damaged components.

Inspecting the hub cover

- Check that the fitting surface is not dented or distorted.
- Check the bearing bearings.
- In case of faults, replace the damaged components.

Refitting the wheel axle bearing

- Support the hub cover on a wooden surface.
- Heat the crankcase cover with the specific heat gun.
- Fit the wheel shaft bearing with a modular punch as shown in the figure.
- Fit the Seeger ring.
- Fit the oil guard with seal lip towards the inside of the hub and place it flush with the internal surface by means of the appropriate tool used from the 52-mm side**.**

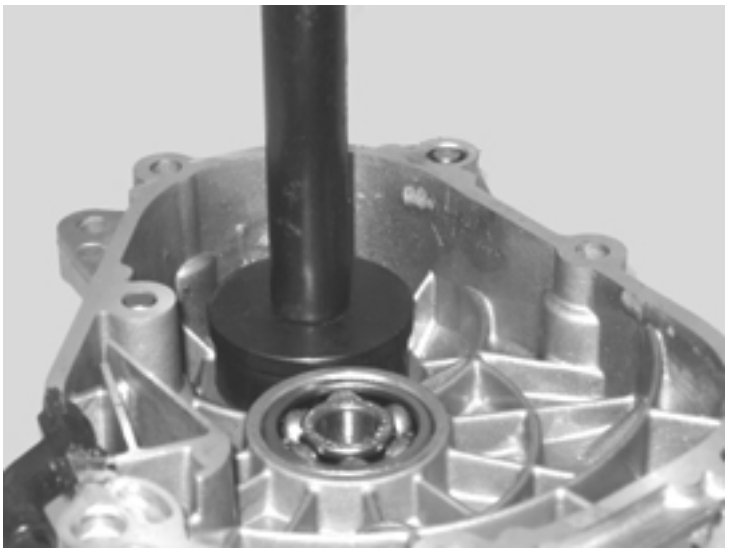
The 52-mm side of the adapter must be turned towards the bearing.

Specific tooling

020376Y Adapter handle

020360Y 52x55-mm Adaptor

020483Y 30 mm guide



Refitting the hub cover bearings

In order to fit the hub box bearings, the engine crankcase and the cover must be heated with the special heat gun.

- The three 15-mm bearings must be fitted using the appropriate tools:
- The 42-mm side of the adapter must be turned towards the bearing.

Specific tooling

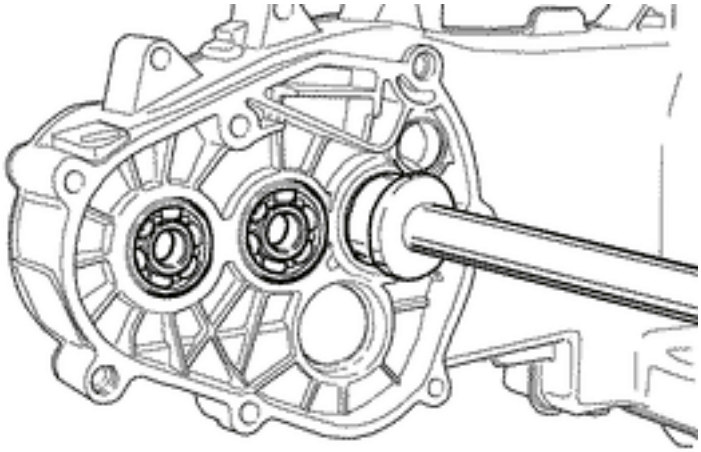
020150Y Air heater mounting

020151Y Air heater

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020412Y 15-mm guide



NOTE

TO FIT THE BEARING ON THE COVER, ADEQUATELY SUPPORT THE COVER WITH THE STUD BOLT KIT.

- Refit the driven pulley shaft bearing with a modular punch as shown in the figure.

NOTE

IF THE BEARING HAS AN ASYMMETRICAL BALL RETAINER, PLACE IT SO THAT THE BALLS ARE VISIBLE FROM THE HUB INNER SIDE.

Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020363Y 20-mm guide

NOTE

WHEN FITTING THE BEARINGS ON THE ENGINE CRANKCASE, SUPPORT THE CRANKCASE PREFERABLY ON A SURFACE TO ALLOW THE BEARINGS TO BE DRIVEN VERTICALLY.

- Refit the Seeger ring with the opening facing the bearing and fit a new oil seal flush with the crankcase from the pulley side.

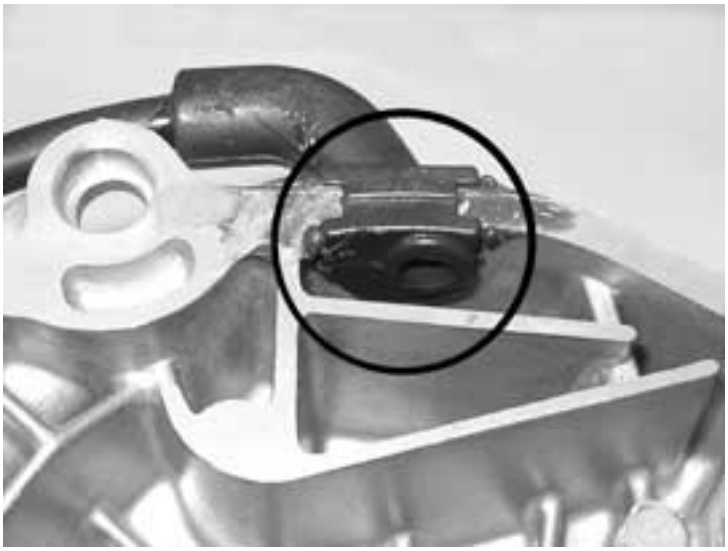
Refitting the hub bearings

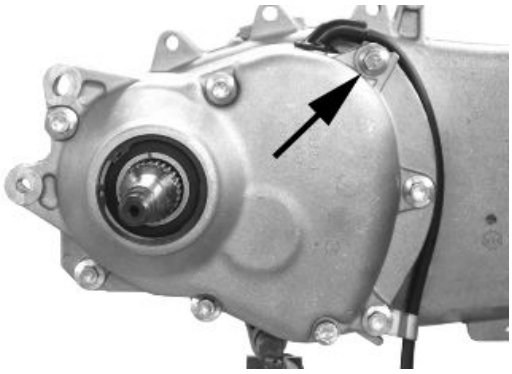
- Install the three shafts in the engine crankcase as shown in the figure.

Refitting the ub cover

- Fit a new gasket together with the alignment dowels.
- Seal the gasket of the breather pipe using black silicone sealant.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.
- Position the shorter screw that can also be recognised from the different colour as shown in the figure.

- Fix the breather tube support by means of the lower screw.
- Fit the remaining screws and tighten the seven screws to the prescribed torque.

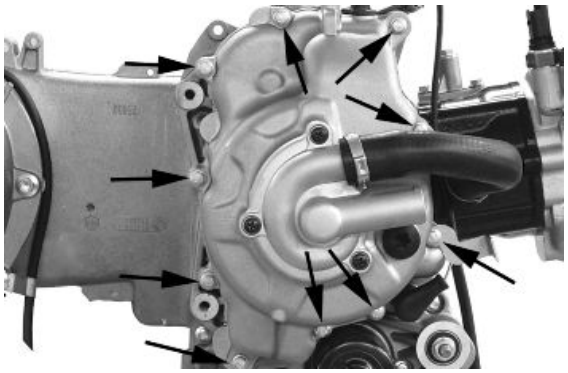




Flywheel cover

Removing the hub cover

- Remove the clip fixing the sleeve to the cylinder.
- Remove the 10 clamps
- Remove the flywheel cover.



Removing the stator

- Remove the two pickup screws and the screw holding the wiring support and the three stator clamping screws shown in the figure.
- Remove the stator and its wiring.

Refitting the stator

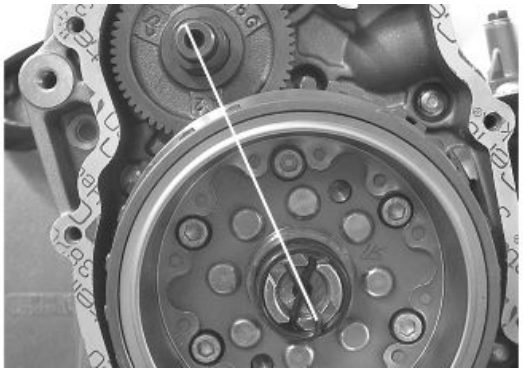
- Refit the stator and flywheel carrying out the removal procedure in reverse, tightening the retainers to the specified torque.

Locking torques (N*m)

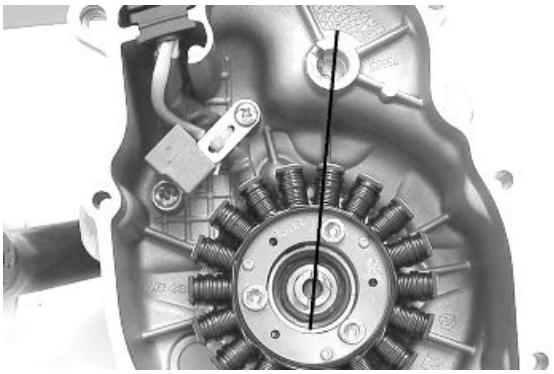
Stator assembly screws (°) **3 to 4**

Refitting the flywheel cover

- Position the spline clip on the crankshaft and orient the end as shown in the figure.



- Orient the water pump shaft with reference to the transmission gear seat as shown in the picture.



- Refit the cover over the engine and tighten the screws to the prescribed torque.
- Carry out the removal steps but in the reverse order.

CAUTION

TAKE CARE TO CORRECTLY POSITION THE FLYWHEEL CONNECTOR. MAKE SURE THE CENTRING DOWELS ARE PRESENT.

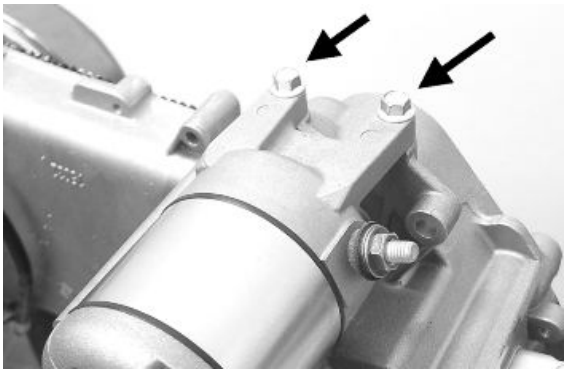
Locking torques (N*m)

Flywheel cover screws 11 - 13

Flywheel and starting

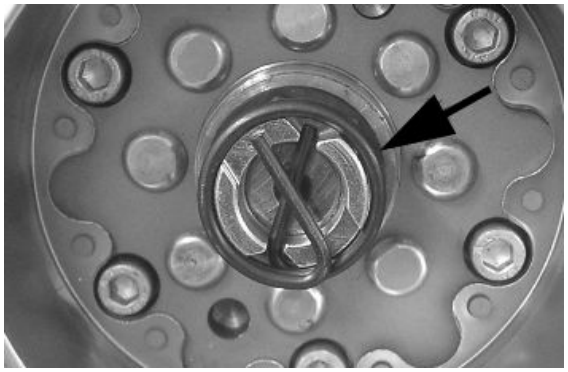
Removing the starter motor

- Remove the two screws indicated in the figure
- Take the starter motor out of its seat

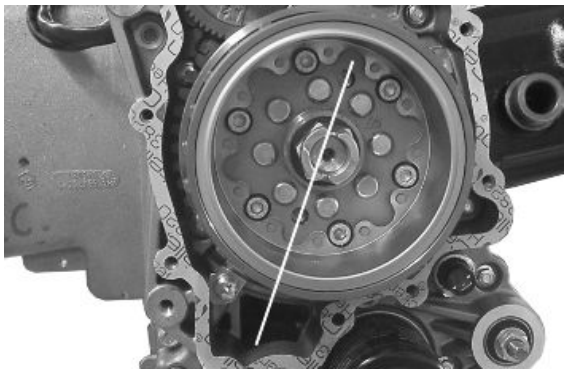


Removing the flywheel magneto

- Remove the water pump shaft and crankshaft spline clip



- Line up the two holes in the flywheel as shown in the picture



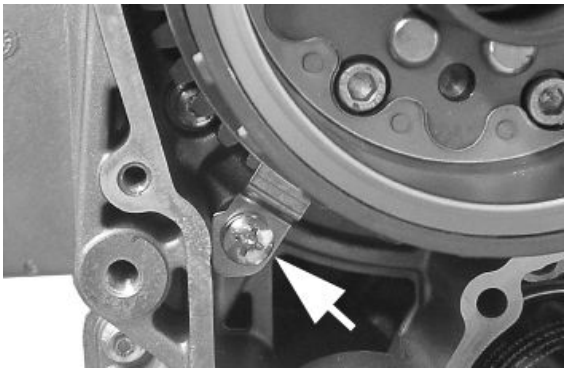
- Screw in the guide bushing that is part of the special flywheel stop tool on the flywheel as shown in the picture

- Insert the special flywheel stop tool on the flywheel as shown in the picture

Specific tooling

020627Y Flywheel lock wrench

Remove the plate indicated in the picture.



- Remove the flywheel nut with its washer
- Do up the flywheel nut by three or four threads so that the flywheel does not fall accidentally on extraction
- Screw the extractor onto the flywheel and extract it as shown in the picture

Specific tooling

020467Y Flywheel extractor

Inspecting the flywheel components

- Check the integrity of the internal plastic parts of the flywheel and the Pickup control plate.

Refitting the free wheel

- Make sure the freewheel faying surfaces are in good condition.
- Thoroughly clean the free wheel to remove LOCTITE residue.
- Degrease the threading of the holes in the free wheel and the clamping screws.
- Apply the recommended product to the end of the screws.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

- Fit the freewheel on the magneto flywheel making sure that the ground side is in contact with the flywheel itself, i.e. with wheel Seeger ring visible.
- Lock the six clamping screws in criss-cross fashion to the prescribed torque.

Locking torques (N*m)

Screw fixing freewheel to flywheel **13 - 15**

- Oil the free wheel "rollers".

Refitting the flywheel magneto

- Remove the freewheel retaining plate indicated in the picture
- Remove the transmission gear and the freewheel

- Insert the free wheel on the flywheel as shown in the picture
- Then refit the flywheel with free wheel and transmission gear

- Using the special flywheel lock wrench, tighten up the flywheel fixing nut to the prescribed torque
- Refit the retention plate

Specific tooling

020627Y Flywheel lock wrench

Locking torques (N*m)

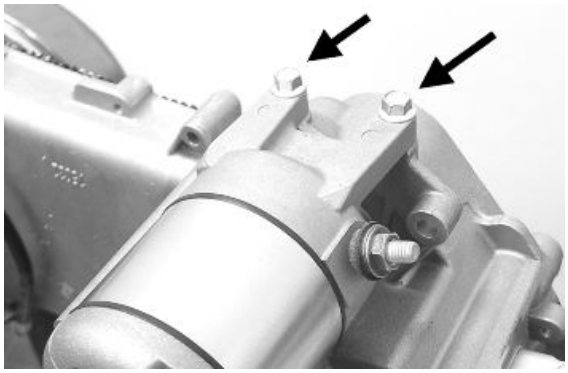
Flywheel nut 94 - 102

Refitting the starter motor

- Fit a new O-ring on the starter motor and lubricate it.
- Fit the starter motor on the crankcase and lock the 2 screws to the prescribed torque.

Locking torques (N*m)

Starter motor screws **11 ÷ 13**



Cylinder assy. and timing system

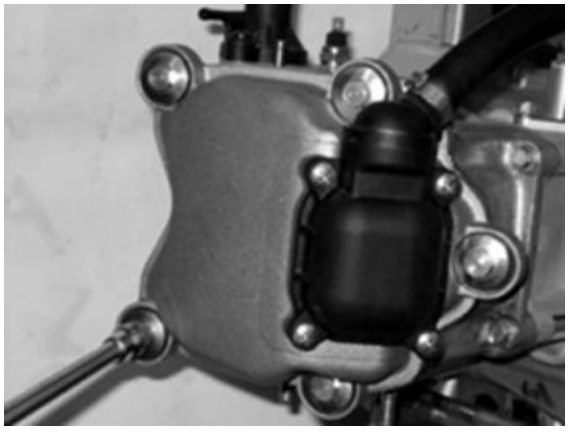
Removing the intake manifold

Loosen the 3 screws and remove the air intake manifold.

- Upon refitting, secure to the specified torque.

Removing the rocker-arms cover

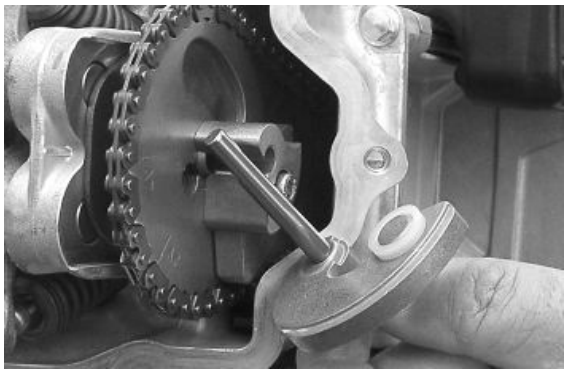
- Remove the 5 screws indicated in the figure



Removing the timing system drive

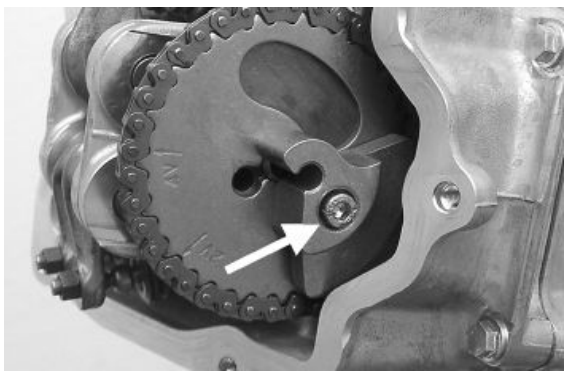
- First remove the parts listed below: transmission cover, drive pulley with belt, oil sump with spring and by-pass piston, oil pump pulley cover, O-ring on the crankshaft and the sprocket wheel separation washer.
- Remove the tappet cover.
- Remove the central screw fastener and the automatic valve-lifter retaining cover, as shown in the figure.

- Remove the return spring of the automatic valve lifter unit and the automatic valve lifter unit and its end of stroke washer.



- Loosen the central screw on the tensioner first.
- Remove the two fixings shown in the figure.
- Remove the tensioner with its gasket.

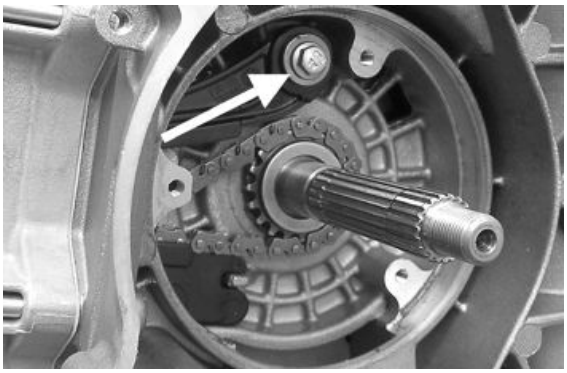
- Remove the internal hex screw and the counterweight shown in the figure.



- Remove the camshaft control pulley with its washer.

- Remove the control sprocket wheel and the timing chain.
- Remove the screws indicated in the figure, the spacer bar and the tensioner slider.

The chain tensioner slider must be removed from the transmission side. As regards the lower chain guide slider, it may only be removed after the head has been removed.

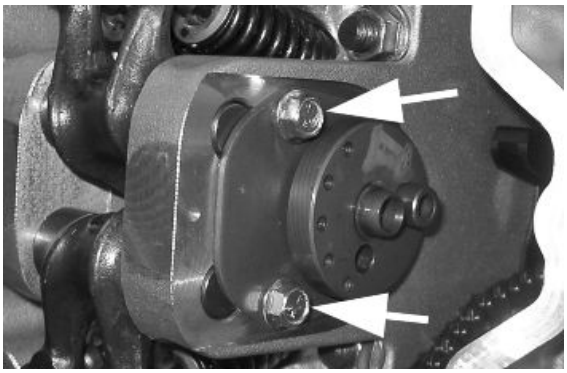


NOTE

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

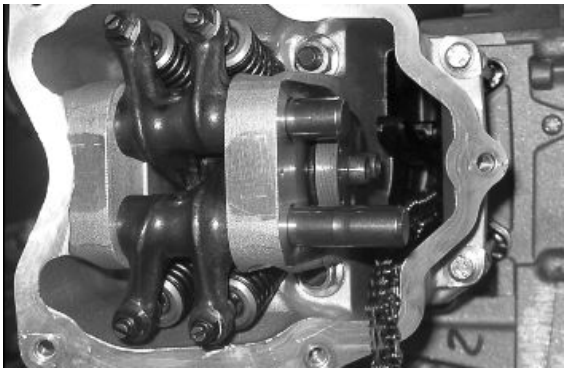
Removing the cam shaft

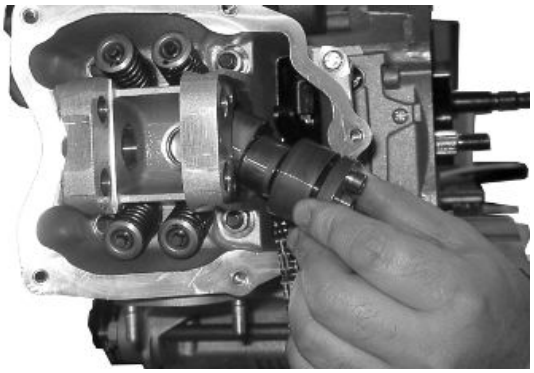
- Remove the 2 screws and the camshaft retainer shown in the diagram.
- Remove the camshaft.
- Remove the pins and the rocking levers from the flywheel side holes.



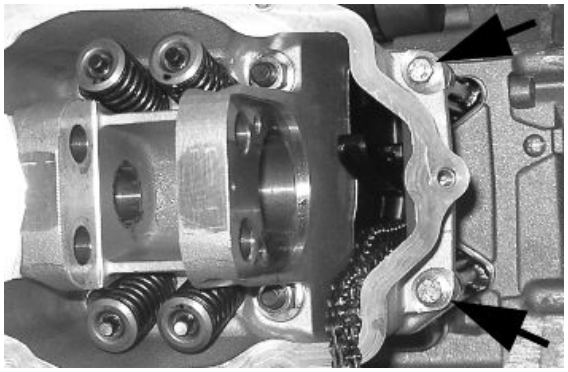
NOTE

IF NEEDED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKER PINS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE CRANKSHAFT CHAIN TENSIONER.





Removing the cylinder head



- Remove the spark plug.
- Remove the 2 side fixings shown in the figure.
- Loosen the 4 head-cylinder fastening nuts in two or three stages and in criss-cross fashion.
- Remove the head, the two alignment dowels and the gasket.

NOTE

IF NEEDED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKER PINS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE CRANKSHAFT CHAIN TENSIONER.

Removing the valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.
- Remove the oil guards with the appropriate tool.
- Remove the lower spring supports.

CAUTION

REPLACE THE VALVES IN SUCH A WAY AS TO RECOGNISE THEIR ORIGINAL POSITION ON THE HEAD.

Specific tooling

020382Y011 adapter for valve removal tool

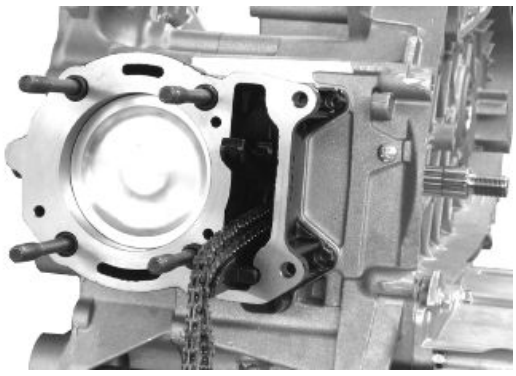
020382Y Valve cotters equipped with part 012 removal tool

020431Y Valve oil seal extractor

Removing the cylinder - piston assy.

Removing cylinder and piston

- Remove the chain guide slider.
- Remove the 4 O-rings on the stud bolts.
- Pull out the cylinder.
- Remove the cylinder base gasket.
- Remove the two stop rings, the wrist pin and the piston.
- Remove the piston seals.

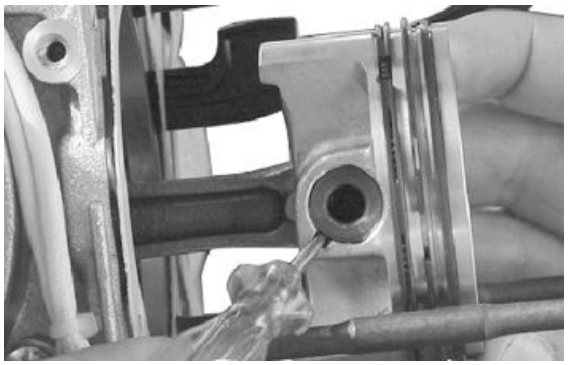


CAUTION

TO AVOID DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

NOTE

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.



Inspecting the small end

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the wrist pin

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the piston

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the cylinder

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the piston rings

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Interventions rules

Removing the piston

- Install piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.
- Fit the wrist pin retainer ring onto the appropriate tool
- With opening in the position indicated on the tool
S = left
D= right
- Place the wrist pin retainer ring into position using a punch
- Fit the wrist pin snap ring using the plug as shown in the figure

NOTE

THE TOOL FOR INSTALLING THE RETAINER RINGS MUST BE USED MANUALLY.

CAUTION

USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

Specific tooling

020454Y Pin lock fitting tool

Choosing the gasket

- Provisionally fit the piston into the cylinder, without any base gasket.
- Assemble a dial gauge on the specific tool.

Specific tooling

020428Y Piston position check mounting

- Using an abutment plane, reset the dial gauge with a preload of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the original head fixing nuts.
- Rotate the crankshaft up to the TDC (the inversion point of the dial gauge rotation)
- Measure the deviation from the reset value.

- By means of the table, see the Specifications chapter identify the cylinder base gasket thickness to be used for refitting. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.

NOTE

IF DEVIATIONS (OR RECESSES OR PROJECTIONS) CLOSE TO THE CHANGE OF CATEGORY ARE MEASURED, REPEAT THE MEASUREMENT AT THE OPPOSED SIDE. TO DO SO, REPEAT THE TOOL INSTALLATION BY INVERTING ITS POSITION.

See also

Refitting the piston rings

- Place the scraper ring spring on the piston.
- Install the scraper ring keeping the opening opposed to the spring junction and with the writing "top" facing the piston crown. The chamfered side of the oil scraper ring should always be facing the piston crown.
- Fit the second lining with the identification letter or the writing "top" facing the piston crown. In any case, the step must be facing opposite the piston crown.
- Install the first compression lining in the direction imposed by the housing.
- It is advisable to use a fitter to facilitate the installation of the linings.

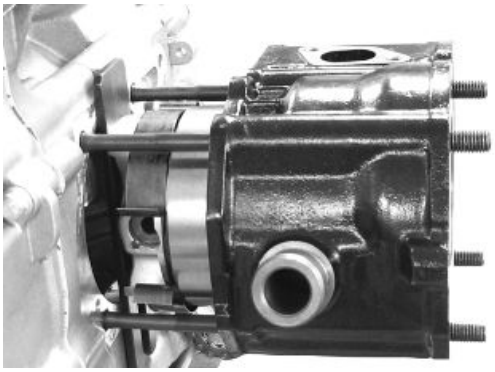
NOTE

THE TWO PISTON RINGS ARE MADE WITH A TAPERED CYLINDRICAL CONTACT CROSS-SECTION. THIS IS TO ACHIEVE A BETTER BEDDING.

- Misalign the lining openings at 120° as shown in the figure.
- Lubricate the components with engine oil.
- The engine uses the first compression lining with an L section.

Refitting the cylinder

- Insert the cylinder base gasket with the thickness determined above.
- Using the fork support and the piston ring retaining band, refit the cylinder as shown in the figure.



NOTE

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW OUT THE LUBRICATION DUCT AND OIL THE CYLINDER LINER.

Specific tooling

020426Y Piston fitting fork

020393Y Piston assembly band

Inspecting the cylinder head

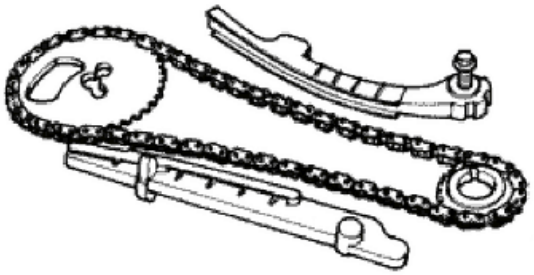
NOTE

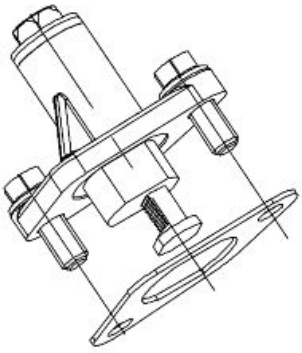
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the timing system components

- Check that the guide slider and the tensioner slider are not worn out.
- Ensure that the camshaft control pulley chain assembly and the sprocket wheel are not worn.
- If you detect wear, replace the parts or, if the chain, sprocket wheel and pulley are worn, replace the whole unit.
- Remove the centre screw with the washer and the tensioner spring. Check that the one-way mechanism is not worn.
- Check the condition of the tensioner spring.
- If examples of wear are found, replace the whole unit.





Inspecting the valve sealings

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the valves

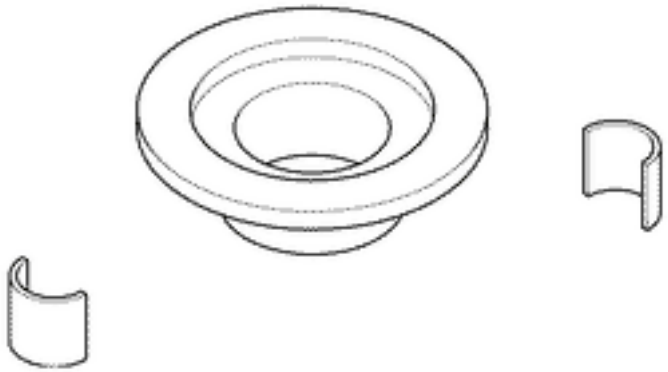
NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the springs and half-cones

- Check that the upper and lower supporting spring washers, the cotters and the oil seal show exhibit no signs of abnormal wear. Replace a component when worn.



- Measure the unloaded spring length.

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Refitting the valves

- Lubricate the valve guides with engine oil.
- Place the valve spring supports on the head.
- Using the special punch, fit the four valve seal rings.
- Fit the valves, the springs and the caps. Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.

NOTE

DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON COTTER SIDE (TURNS WITH GREATER PITCH).

Specific tooling

020306Y Punch for assembling valve seal rings

020382Y Valve cotters equipped with part 012 removal tool

020382Y011 adapter for valve removal tool

Inspecting the cam shaft

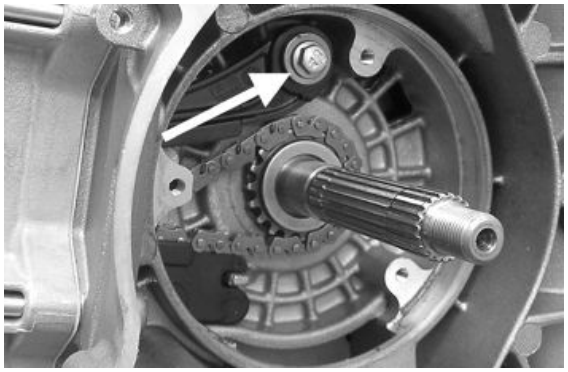
NOTE

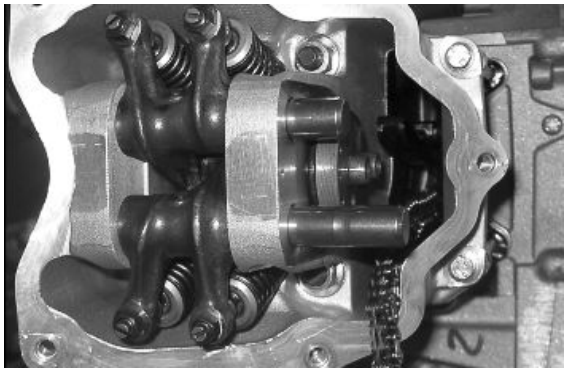
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Refitting the head and timing system components

- Refit the lower timing chain sprocket wheel on the crankshaft, with the chamfer facing the insertion side.
- Loop the timing chain around the sprocket on the crankshaft.
- Fit the chain tensioner slider from the cylinder head side.
- Fit the spacer and the screw fastener.
- Tighten the screws to the prescribed torque.
- Fit the pins and rocking levers.
- Lubricate the two rocking levers through the holes at the top.
- Lubricate the 2 bearings and insert the camshaft in the cylinder head with the cams corresponding to the rocking levers.
- Insert the retention plate and tighten the two screws shown in the figure to the prescribed torque.
- Refit the spacer on the camshaft.
- Rotate the engine so that the piston is at top dead centre, using the reference marks on the flywheel and the crankcase.
- Holding this position insert the chain on the camshaft control pulley.
- Insert the pulley on the camshaft while keeping the reference **4V** in correspondence with the reference mark on the head.
- Fit the counterweight and tighten the clamping screw to the prescribed torque.
-Fit the end-stop ring on the automatic valve-lifter cam and fit the automatic valve-lifter cam to the camshaft.
- Fit the automatic valve lifter return spring.
- During this operation the spring must be loaded by approximately 180°.



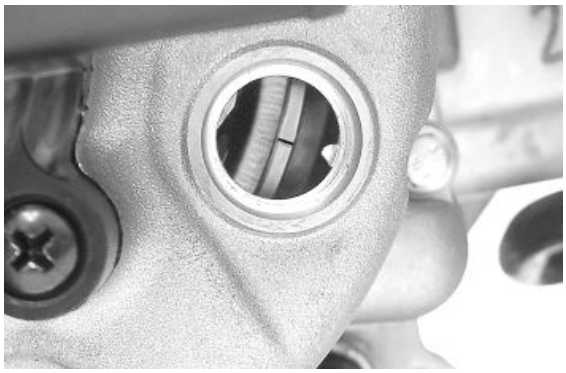


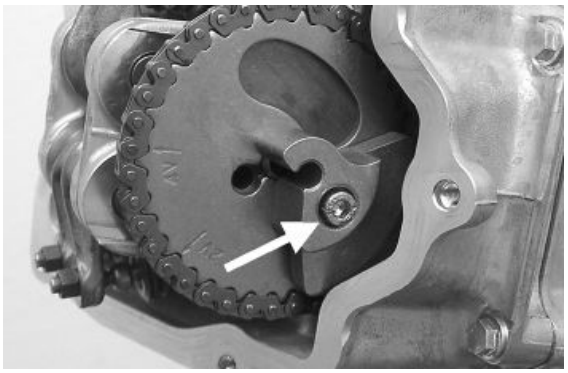
- Fit the automatic valve-lifter retaining dish, using the counterweight screw fastener as a reference.
- Tighten the clamping screw to the prescribed torque.
- Set the tensioner cursor in the rest position.
- Fit the chain tensioner on the cylinder, using a new gasket, and tight the two screws to the prescribed torque.
- Insert the chain tensioning screw, together with the spring and washer, tightening it to the prescribed torque.
- Adjust the valve clearance.
- Fit the spark plug.

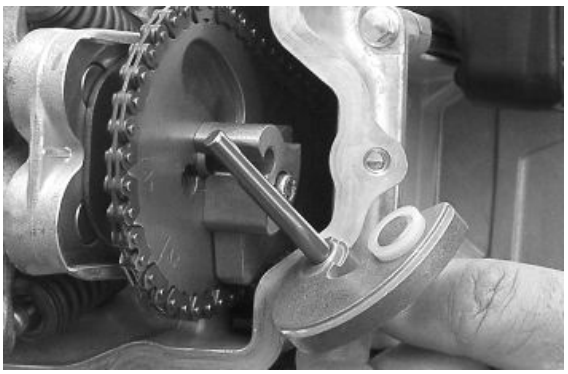
Electrode distance 0.8 mm

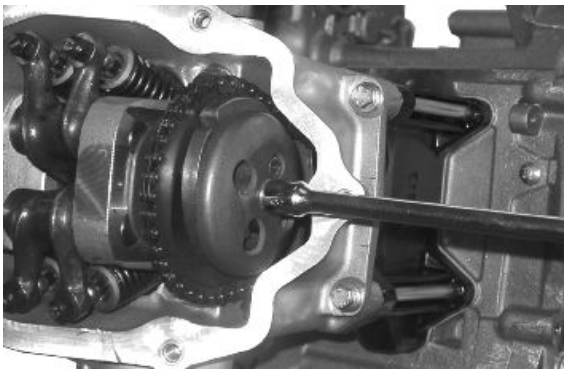
NOTE

GREASE THE END STOP RING TO PREVENT IT COMING OUT AND FALLING INTO THE ENGINE.





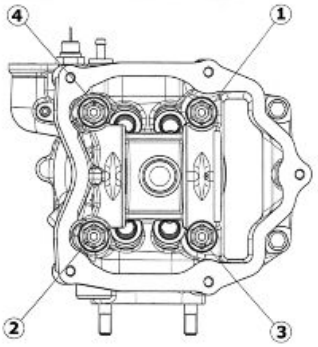




Locking torques (N*m)

Timing chain tensioner support screw 11 to 13
Spark plug 12 to 14 **Starter ground screw** 7 to 8.5
Timing chain tensioner slider screw 10 to 14
Starter counterweight support screw 11 to 15
Timing chain tensioner central screw 5 to 6
Camshaft retention plate screw 4 to 6

- Fit the timing chain guide slider.
- Insert the centring dowel between the cylinder head to the cylinder, fit the cylinder head gasket and the cylinder head.
- Lubricate the stud bolt threading.
- Tighten up the nuts to an initial pre-torque of 7±1 N·m
- Tighten up the nuts to a second pre-torque of 10 ±1 N·m
- Rotate by an angle of 270°
- To carry out the operations described above, follow the tightening sequence in the figure.
- Fit the two screws on the outside of the timing chain side and tighten them to the specified torque.

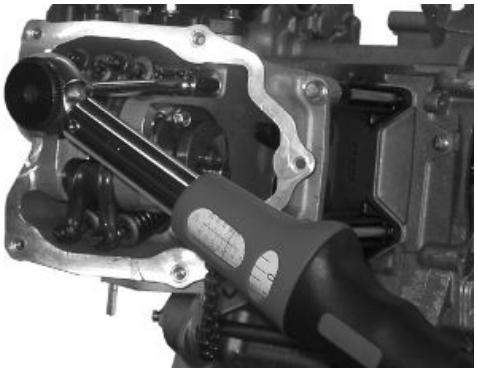


NOTE

BEFORE INSTALLING THE HEAD, MAKE SURE THAT THE LUBRICATION CHANNEL IS CLEAN USING A COMPRESSED AIR JET.

Locking torques (N*m)

Timing chain tensioner support screw **11 to 13**

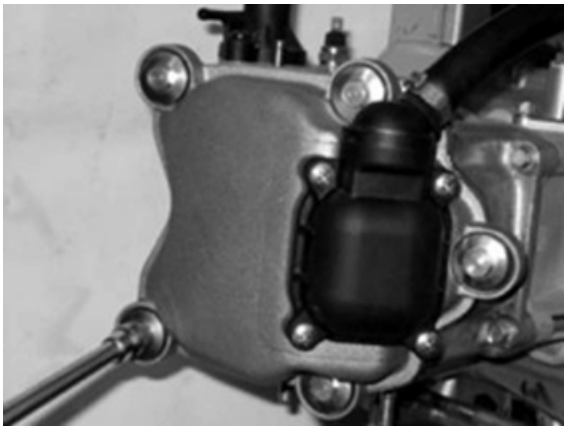


Refitting the rocker-arms cover

- Refit the cylinder head cover and tighten the 5 clamping screws to the prescribed torque.
- Make sure the gasket is positioned properly.

Locking torques (N*m)

Tappet cover screws **6 - 7 Nm**



Refitting the intake manifold

- Fit the intake manifold and do up the three screws.

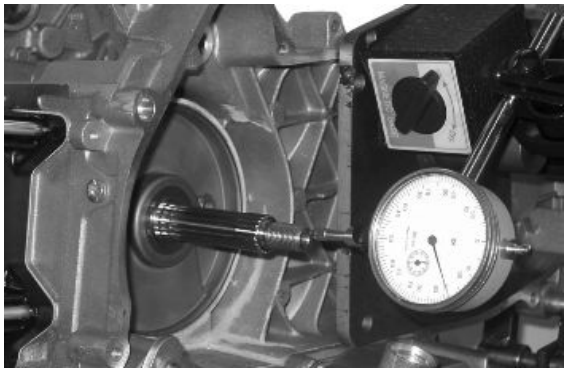
Locking torques (N*m)

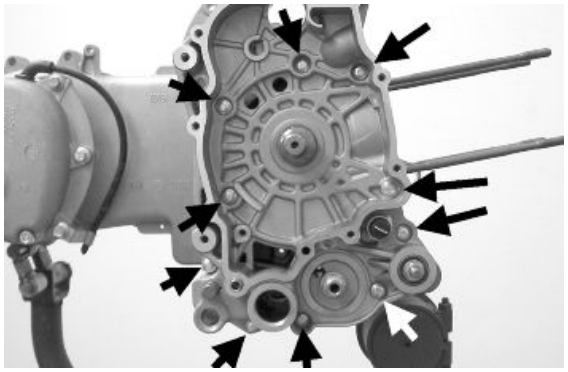
Intake manifold screws **11 to 13**

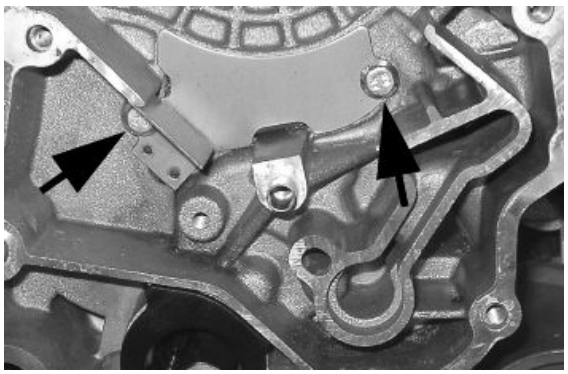
Crankcase - crankshaft

Splitting the crankcase halves

- Before opening the crankcase, it is advisable to check the axial clearance of the crankshaft. To do this, use a plate and a support with appropriate tool dial gauge.
- Upper clearances are an indication of wear on the surfaces of the crankshaft casing support.
- Remove the 10 crankshaft coupling screws.
- Separate the crankcase while keeping the crankshaft in one of the two halves of the crankcase.
- Remove the crankshaft.
- Remove the half crankcase coupling gasket.
- Remove the two screws and the internal cover shown in the diagram.
- Remove the oil guard on the flywheel side.
- Remove the oil filter fitting shown in the diagram.
- Check the axial clearance on the connecting rod.
- Check the radial clearance on the connecting rod.
-Check the surfaces that limit the axial free-play are not scored and measure the width of the crankshaft between these surfaces, as shown in the diagram.
- If the axial clearance between crankshaft and crankcase is exceeding and the crankshaft does not have any defect, the problem must be due to either excessive wear or wrong machining on the crankcase.
- Check the diameters of both the bearings of the crankshaft in accordance with the axes and surfaces shown in the figure. The half-shafts are classified in two categories Cat. 1 and Cat. 2 as shown the chart below.







CAUTION

THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH IS WITHIN THE STANDARD VALUES AND THE SURFACES SHOW NO SIGNS OF SCORING.

CAUTION

WHILE OPENING THE CRANKCASES AND REMOVING THE CRANKSHAFT, CHECK THAT THE THREADED SHAFT ENDS DO NOT INTERFERE WITH THE MAIN BUSH-

INGS. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BUSHINGS.

CAUTION

KEEP THE CRANKSHAFT IN ONE OF THE TWO HALVES OF THE CRANKCASE WHEN SEPARATING IT. IF YOU FAIL TO DO THIS, THE CRANKSHAFT MIGHT ACCIDENTALLY FALL.

NOTE

WHEN MEASURING THE WIDTH OF THE CRANKSHAFT, MAKE SURE THAT THE MEASUREMENTS ARE NOT MODIFIED BY THE RADIUSES OF FITTINGS WITH THE CRANKSHAFT BEARINGS.

NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

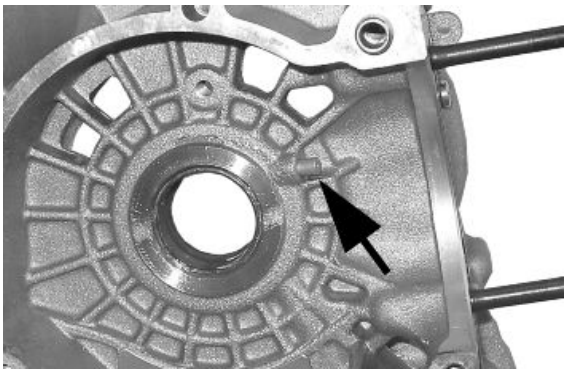
Inspecting the crankshaft alignment

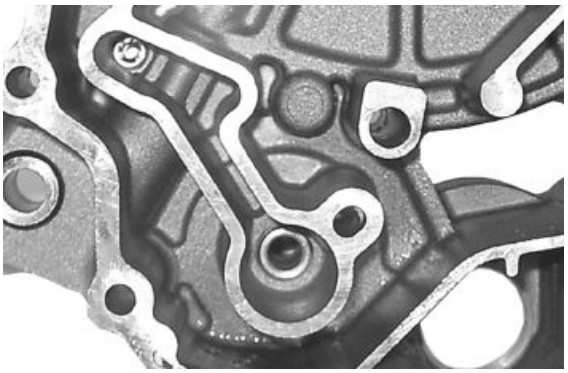
NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Inspecting the crankcase halves



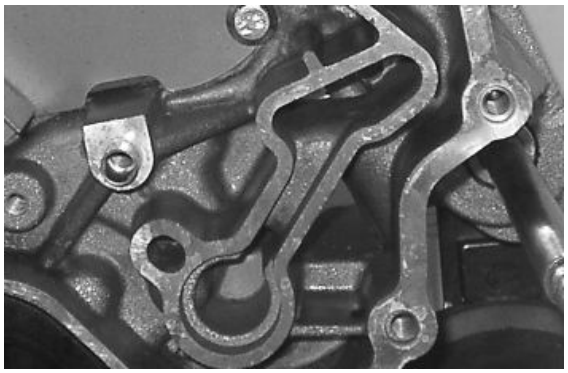


- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- On the transmission-side crankcase half, take particular care when handling the oil pump compartment and the oil ducts, the by-pass duct, the main bushings and the cooling jet on the transmission side (see diagram).
- Take particular care, also, that there are no signs wear in the oil by-pass valve housing (see Chapter Lubrication), as this could prevent a good seal in the piston, which regulates the oil pressure.
- On the flywheel side crankcase half, take particular care cleaning the oil ducts for the main bushings, the oil duct for the jet that lubricates the cylinder head and the oil drainage duct at the flywheel side oil seal.
- Inspect the coupling surfaces on the crankcase halves for scratches or deformation, taking partic-

ular care with the cylinder/crankcase surfaces and the crankcase halves surfaces.

- Defects in the crankcase coupling gasket between the crankcase halves or the mating surfaces shown in the diagram, could cause a drop in the oil pressure lubricating the main bushings and connecting rod.

- Check the main bearing seats that limit axial clearance in the crankshaft show no signs of wear. The dimension between these seats is measured by way of the procedure described previously for measuring the crankshaft axial clearance and dimensions.



NOTE

THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES PISTON CROWN COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAKS CAN CAUSE A CONSIDERABLE DROP IN THE LUBRICATION PRESSURE FOR MAIN BUSHINGS AND CONNECTING ROD.

NOTE

THE HEAD LUBRICATION CHANNEL IS PROVIDED WITH A SHUTTER JET; THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION; THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP. THE JET CLOGGING IMPAIRS THE HEAD LUBRICATION AND THE TIMING MECHANISMS. A JET FAILURE CAUSES A DECREASE OF THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.

Inspecting the crankshaft plain bearings

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.

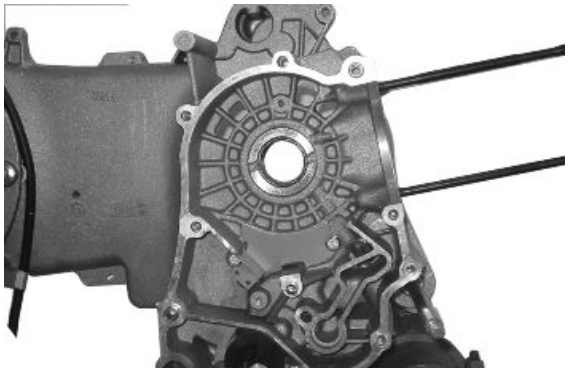
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.

Characteristic

Lubrication pressure

3.5 to 4 bar

- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposed the cylinder.
- To prevent shutters in the oil feeding channels, the matching surface of the two half-bearings must be perfectly orthogonal to the cylinder axis, as shown in the figure.
- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.



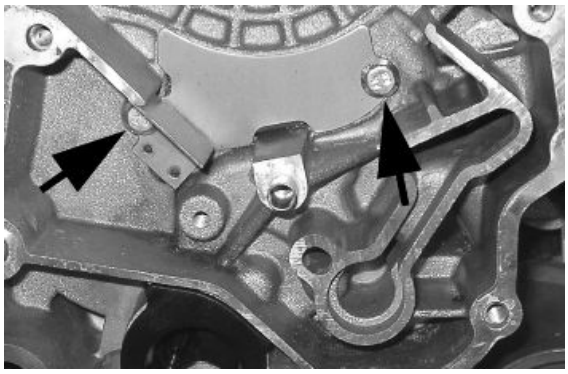
NOTE

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

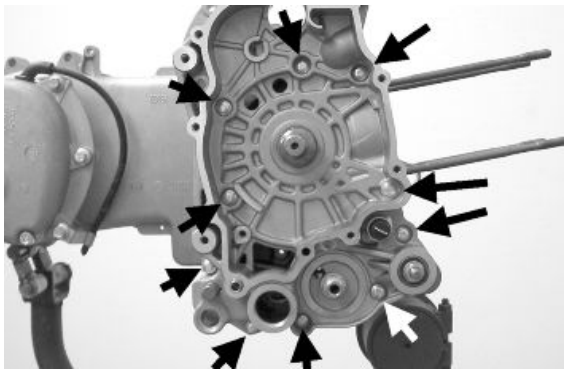
Refitting the crankcase halves

- Fit the internal shield by locking the two screws to the prescribed torque.
- Fit the oil filter fitting and tighten it to the prescribed torque.
- Position the oil pre-filter element as shown in the picture.
- Place a new gasket on one of the crankcase halves, preferably on the transmission side, together with the alignment dowels.
- Lubricate the main bushings and insert the crankshaft in the transmission side crankcase half.
- Reassemble both crankcase halves.
- Fit the 10 screws and tighten them to the specified torque.
- Fit a new O-ring on the pre-filter and lubricate it.
- Insert the filter on the engine with the relative cap. Tighten to the prescribed torque.



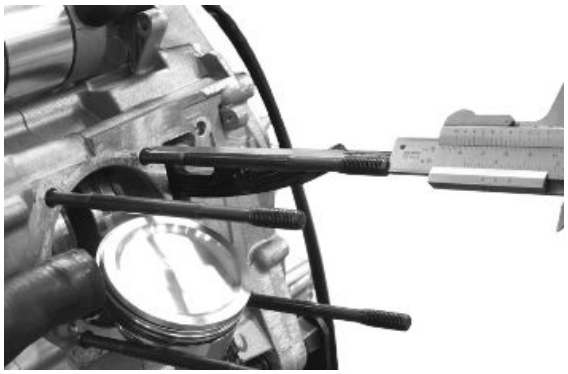
Locking torques (N*m)

Internal engine crankcase bulkhead (transmission-side half shaft) screws 4 to 6 **Engine-crankcase coupling screws** 11 to 13 **Oil filter on crankcase fitting** 27 to 33 **Engine oil drainage plug/ mesh filter** 24 to 30



Studs

Check that the stud bolts have not worked loose from their seat in the crankcase.
Check the depth of stud bolt driving with a gauge, as indicated in the picture. If it varies significantly from the driving depth indicated, it means that the stud bolt has yielded.
In this case, replace it.

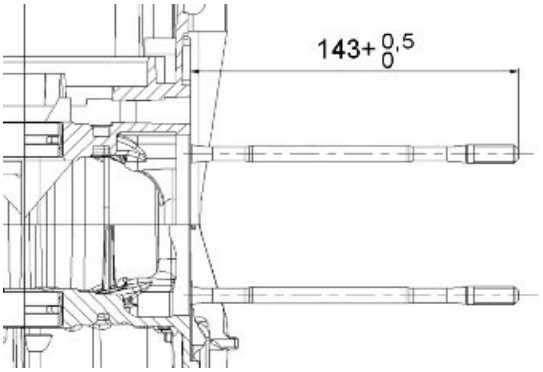


By working on two fitted cylinder head fixing nuts, nut and lock nut, as shown in the picture, remove the stud bolt from its seat.

Clean the threaded seat on the carter thoroughly.

Refit a new stud bolt and apply the special product on the threading crankcase side.

Tighten up to the depth of the driving indicated.



Recommended products

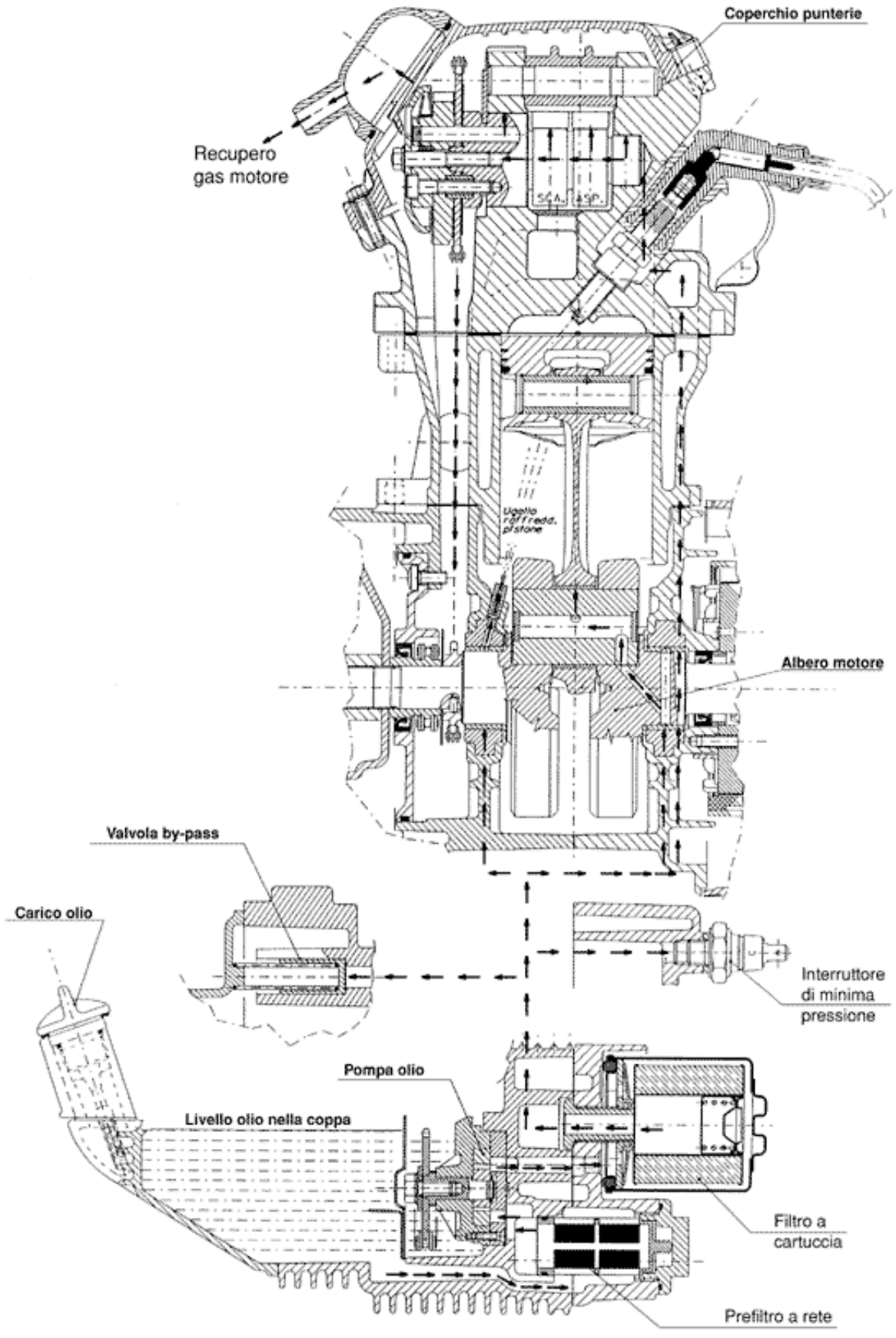
Loctite Quick Set Loctite 270 high strength threadlock

Loctite 270 high strength threadlock

Lubrication

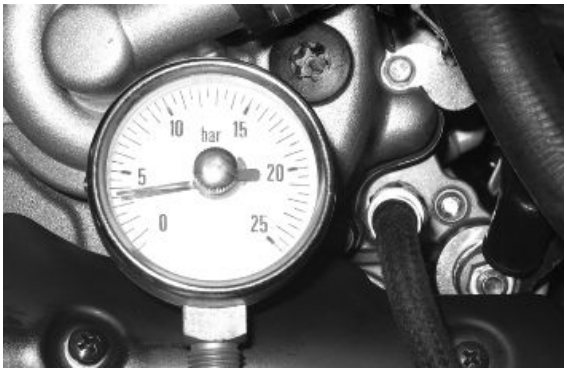
Conceptual diagrams

LUBRICATION CIRCUIT


Coperchio punterie
Recupero gas motore
Albero motore
Valvola by-pass
Carico olio
Interruttore di minima pressione
Pompa olio
Livello olio nella coppa
Filtro a cartuccia
Prefiltro a rete

Oil pressure check

- Remove the electrical minimum oil pressure switch connection and remove the switch.
- Check that the oil pressure reading is between 0.5 and 1.2 atm with the engine idling at 1650 rpm and the oil at the required temperature (wait for at least one electric ventilation).
- Check that the oil pressure is between 3.2 and 4.2 atm with the engine running at 6000 rpm and the oil at the required temperature.
- Remove the appropriate tools once the measurement is complete, refit the oil pressure switch and washer, tightening it to the specified torque and fit the flywheel cover.
- If the oil pressure is not within the specified limits, in the following order, check: the oil filter, the oil by-pass valve, the oil pump and the crankshaft seals.



NOTE

THE CHECK MUST BE CARRIED OUT WITH OIL AT THE CORRECT LEVEL AND WITH AN OIL FILTER IN PROPER CONDITION.

Characteristic

Oil pressure

Minimum pressure admitted at 6000 rpm: 3.2 atm.

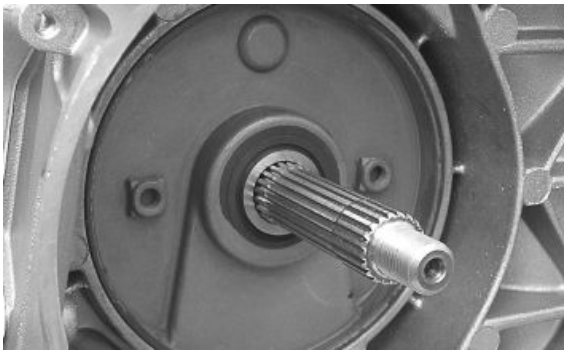
Locking torques (N*m)

Minimum oil pressure sensor **12 to 14**

Crankshaft oil seals

Removal

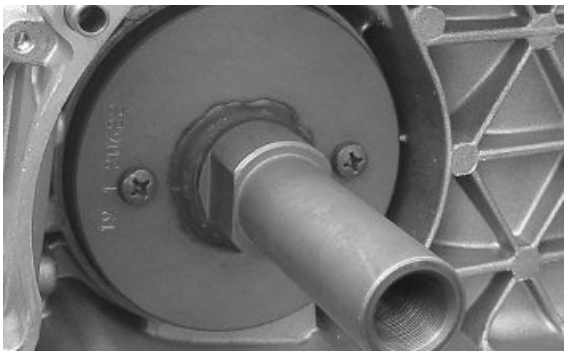
- Remove the transmission cover and the complete drive pulley beforehand



- Install the base of the appropriate tool on the oil seal using the screws provided.

Specific tooling

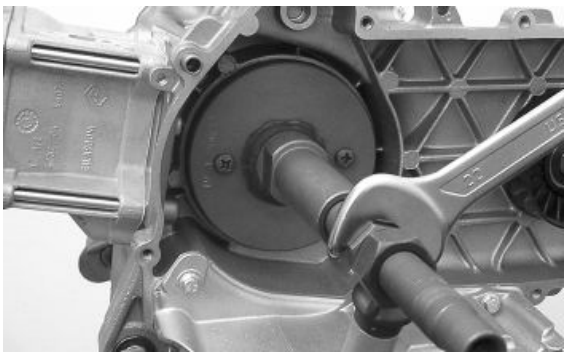
020622Y Transmission-side oil seal punch



- Screw the threaded bar onto the base of the tool and extract the oil seal.

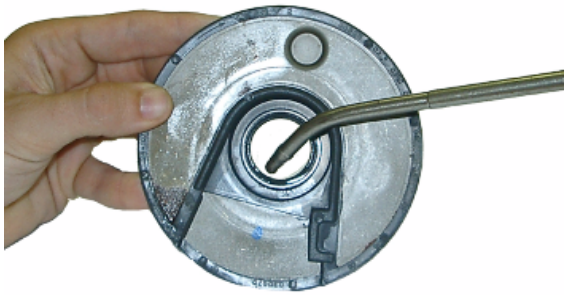
Specific tooling

020622Y Transmission-side oil seal punch



Refitting

- Always use a new oil seal upon refitting
- Prepare the new oil guard by lubricating the sealing lip.
- Preassemble the oil seal with the appropriate tool by positioning the screws.
- Insert the sheath over the crankshaft.
- Insert the tool with the oil seal on the crankshaft until it comes into contact with the crankcase.
- Insert the adaptor bushing of the tool in the hole on the crankcase.



- Orientate the oil seal by inserting the bracket which is part of the appropriate tool.
- Tighten the threaded bar onto the crankshaft as far as it will go.
- Use the nut to move the base of the tool until you can see the end of the oil seal driving stroke
- Remove all the tool components following the procedure but in reverse order

CAUTION

DO NOT LUBRICATE THE KEYING SURFACE ONTO THE ENGINE CRANKCASE.

CAUTION

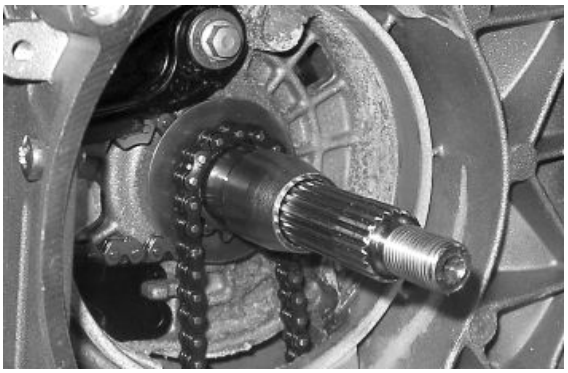
ORIENT THE OIL SEAL BY POSITIONING THE CHAIN HOUSING CHANNEL FACING DOWNWARDS. WHEN THE POSITION IS REACHED, DO NOT RETRACT THE OIL SEAL. FAILURE TO COMPLY WITH THIS RULE CAN CAUSE A WRONG POSITIONING OF THE OIL SEAL SHEATH.

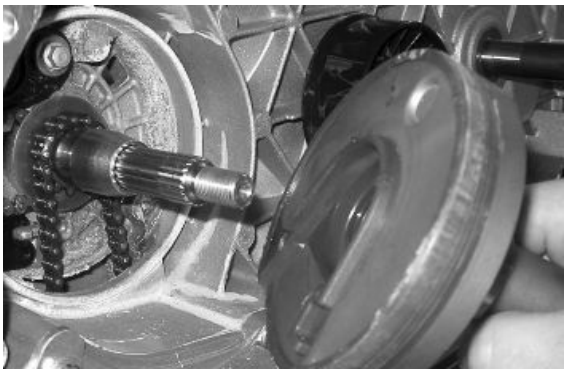
CAUTION

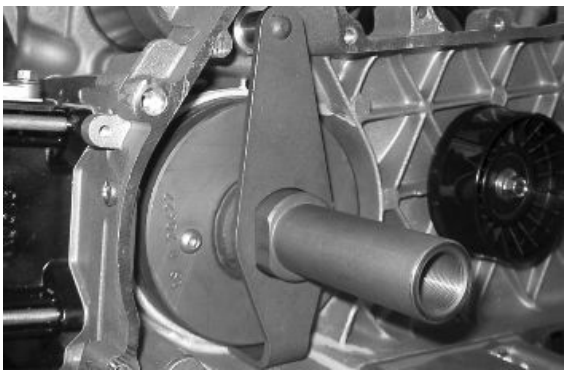
FAILURE TO COMPLY WITH THIS ASSEMBLY PROCEDURE CAN SERIOUSLY DAMAGE THE ENGINE DUE TO THE WRONG TENSIONING OF THE OIL PUMP CONTROL CHAIN.

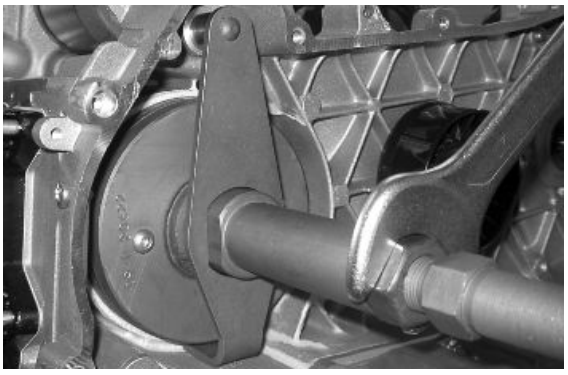
Specific tooling

020622Y Transmission-side oil seal punch





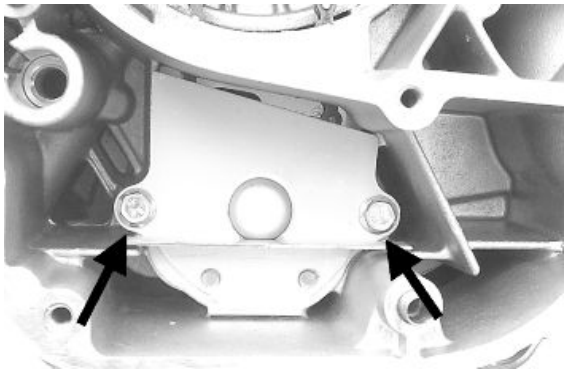




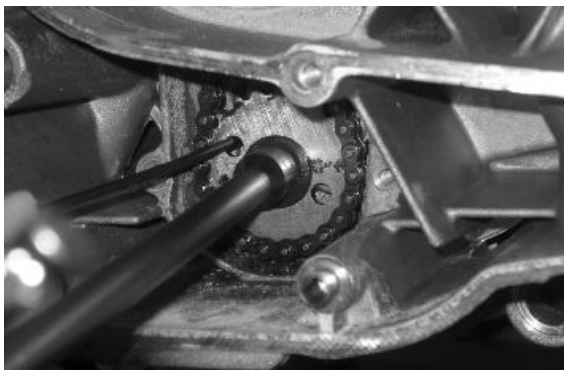
Oil pump

Removal

- Undo the two clamping screws in the figure and remove the cover over the pump control sprocket.



- Block the rotation of the oil pump control pulley with a screwdriver inserted through one of its two holes.
- Remove the central screw with Belleville washer, as shown in the diagram.
- Remove the chain with the crown.
- Remove the control sprocket wheel with relative O-ring.



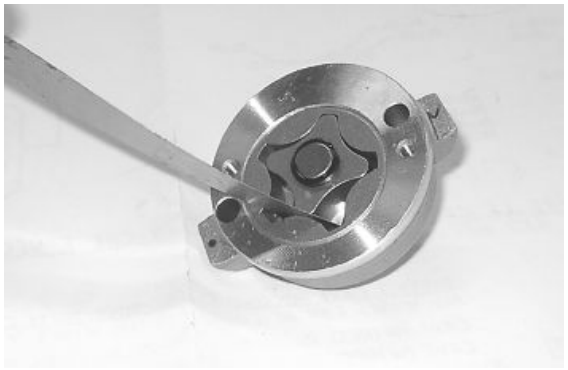
- Remove the oil pump by undoing the two screws in the figure.
- Remove the oil pump seal.

NOTE

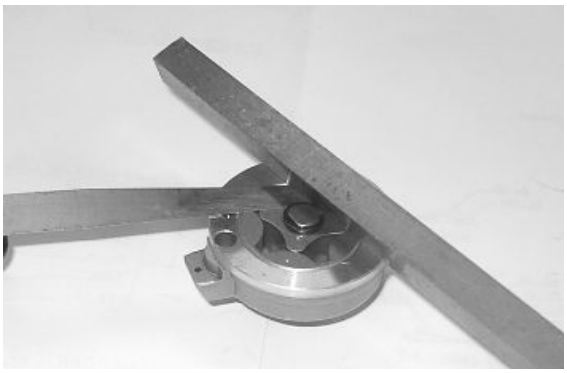
IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

Inspection

- Remove the two screws and the oil pump cover.
- Remove the circlip retaining the innermost rotor.
- Remove and wash the rotors thoroughly with petrol and compressed air.
- Reassemble the rotors in the pump body, keeping the two reference marks visible Replace the retainer ring.



- Check the clearance between the rotors in the position shown in the diagram using a feeler gauge.
Measure the distance between the outer rotor and the pump body (see figure).
- Check the axial clearance of the rotors using a trued bar as shown in the figure.



Characteristic

Axial rotor clearance

Limit values admitted: 0.09 mm

Distance between the outer rotor and the pump body

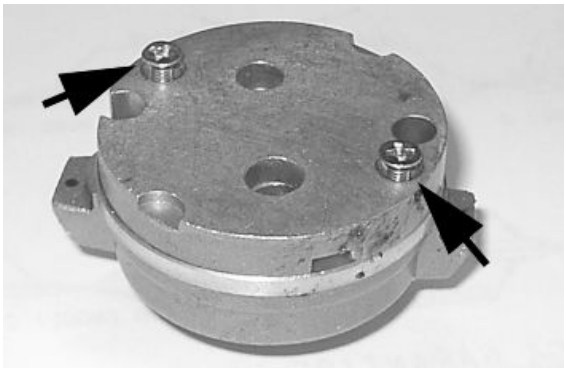
Admissible limit clearance: 0.20 mm

Distance between the rotors

Admissible limit clearance: 0.12 mm

Refitting

- Check there are no signs of wear on the oil pump shaft or body.
- Check there are no signs of scoring or wear on the oil pump cover.
- If you detect non-conforming measurements or scoring, replace the faulty parts or the unit.
- Fit the pump cover in the position that permits the crankcase clamping screws to be aligned.



- Make sure the gasket is positioned properly and refit the pump on the engine crankcase. The pump can only be fitted in one position. - Tighten the screws to the prescribed torque.
- Fit the sprocket wheel with a new O-ring.
- Fit the chain.
- Fit the central screw and the cup washer. Tighten to the prescribed torque.
-Fit the oil pump cover, by tightening the two screws to the prescribed torque.

NOTE

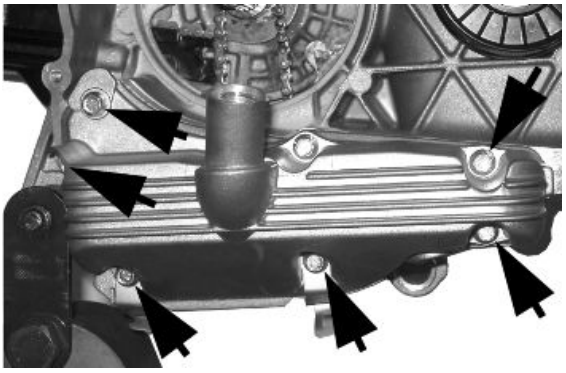
FIT THE CUP WASHER SO THAT ITS OUTER RIM TOUCHES THE PULLEY. MAKE SURE THAT THE PUMP TURNS FREELY.

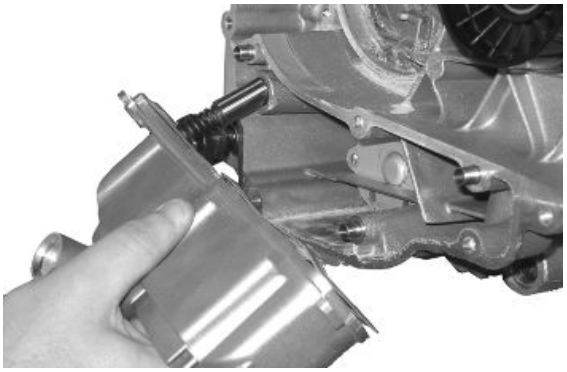
Locking torques (N*m)

Screws fixing oil pump to the crankcase 5 to 6
Oil pump command sprocket screw 10 to 14 **Oil pump cover screws** 0.7 - 0.9

Removing the oil sump

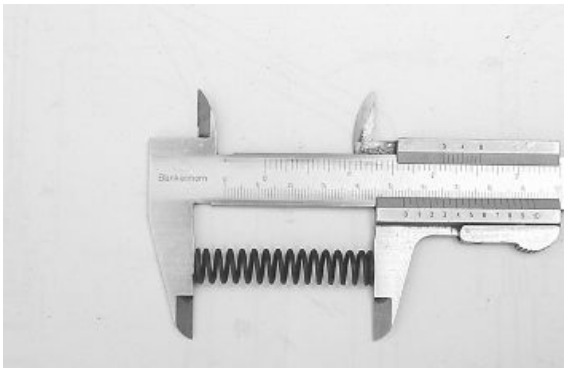
- Remove the oil filler plug, the transmission cover, the complete driving pulley assembly with belt and the sprocket wheel, as described in the "Transmission" chapter.
- Drain the oil as described above.
- Remove the 7 screws, shown in the diagram, and the 2 rear brake fluid pipe fixing brackets.
- Remove the screw, the by-pass piston, the gasket and the centring dowels shown in the figure.





Inspecting the by-pass valve

- Check the unloaded spring length.
- Check that the small piston is not scored.
- Ensure that it slides freely on the crankcase and that it guarantees a good seal.
- If not, eliminate any impurities or replace defective parts.



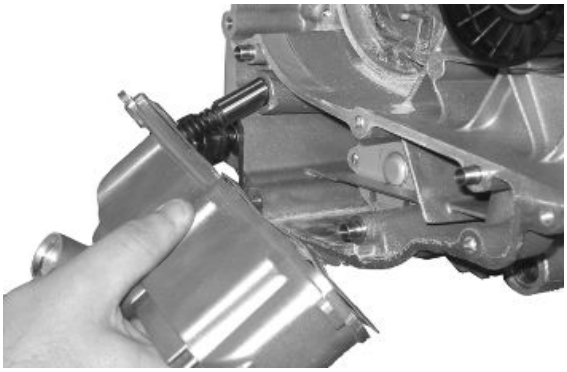
Characteristic

By-pass check up: Standard length

54.2 mm

Refitting the oil sump

- Refit the by-pass piston in its housing.
- Insert the pressure-regulating spring.
- Fit a new sump seal.
- Refit the two centring dowels.
- Refit the sump, taking care to locate the spring in the appropriate recess machined into the inside of the sump.
- Refit the rear brake cable brackets and the screws in the reverse order from which they were removed.
- Tighten the screws to the prescribed torque.
- Refit the driving pulley assembly, the drive belt, the sprocket wheel and the transmission cover, as described in the "Transmission" chapter.



- When testing the lubrication system, refer to chapter "Crankcase and Crankshaft", regarding lubrication of the crankshaft and connecting rod

Locking torques (N*m)

Oil sump screws **10 to 14**

INDEX OF TOPICS

INJECTION INJEC

INJECTION COMPONENTS

	Specification	Desc./Quantity
1	Throttle body and electronic injection control unit (MIU)	
2	Fuel injector	
3	Diagnostics socket connector	
4	Injection load remote control	
5	Electric fan	
6	Fuel pump	
7	Lambda Probe	
8	Engine Speed sensor	
9	HV coil	
10	Water temperature sensor	

MIU injection system

This vehicle is fitted with an integrated injection and ignition system.

Injection is indirect in the manifold through an electro-injector.

The injection and ignition are timed on the four-stroke cycle by means of a tone wheel keyed on to the crankshaft (24-2 teeth) and pick-up sensor.

Combustion and ignition are managed on the basis of engine revs and throttle valve opening. Further corrections are made according to the following parameters:

- Coolant temperature.
- Intake air temperature
- Lambda probe

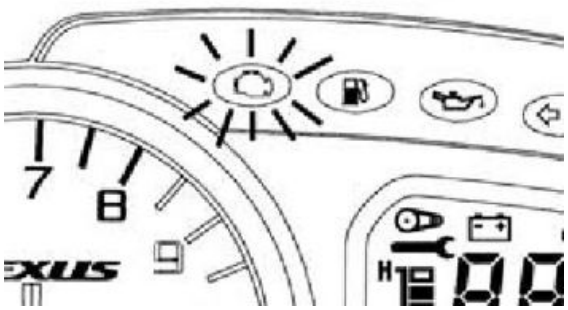
The system implements an idle feeding correction with cold engine through a Stepper motor on a by-pass circuit of the throttle valve. The control unit manages the Stepper motor and the injector opening time, thereby ensuring the idle steadiness and the proper combustion.

In all conditions of use, mixture preparation is managed by modifying the injector opening time.
The fuel system pressure is kept constant based on the ambient pressure.
The **fuel supply circuit** consists of:
- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

The pump, the filter and the regulator are placed inside the fuel tank on a single support.
The injector is connected by a pipe with fast-release fitting. The pressure regulator is located at the beginning of the circuit.
The fuel pump is controlled by the MIU control unit ; this ensures the scooter safety
The **ignition circuit** consists of:
- HV coil
- HV cable
- Shielded cap
- MIU control unit
- Spark plug

The MIU control unit manages ignition with the best advance ensuring four-stroke timing (ignition only in the compression phase) at the same time.
The MIU injection-ignition system controls engine functions by means of a pre-set program.
Should any input signals fail, an acceptable working order of the engine is ensured to allow the user to reach a service station.
Of course, this cannot happen when the rpm-timing signal is missing, or when the failure involves the control circuits:
- Fuel pump
- HV coil
- Injector

The control unit is provided with a self-diagnosis system connected to an indicator light in the instrument panel.



Failures are detected and restored by the diagnostic tester.
In any case, when the fault is no longer present, the data storage is automatically cleared after 16 cycles of use (cold start, running at regular engine temperature, stop).

The diagnostic tester is also required to adjust the idle mixture.

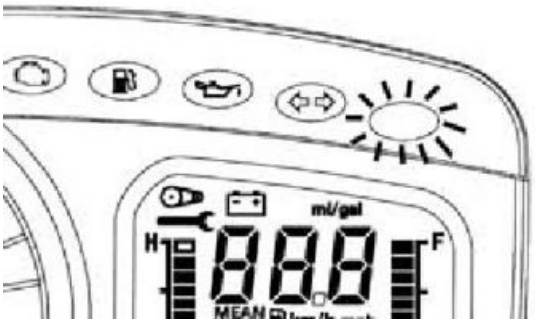
Specific tooling

020680Y Diagnosis Tool

The MIU injection-ignition system carries out checks on the rpm indicator and the electric fan for radiator cooling.

The MIU control unit has a decoder for the anti-theft immobilizer system.

The MIU control unit is connected to a diagnostic LED on the instrument panel, that also carries out the deterrent flashing functions.



The MIU control unit power supply is furthermore controlled by the emergency switch; that is to provide further safety for the vehicle.

Precautions

Troubleshooting hints

1 A MIU failure is more likely to be due to the connections than to the components.

Before troubleshooting the MIU system, carry out the following checks:

A: Electrical power supply

a. Battery voltage

b. Blown fuse

c. Remote controls

d. Connectors

B: Chassis ground

C: Fuel system

a. Broken fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty spark plug

b. Broken coil

c. Broken shielded cap

E: Intake circuit

a. Dirty air filter

b. Dirty by-pass circuit

c. Faulty Stepper motor

F: Other

a. Incorrect distribution timing

b. Wrong idle mixture

c.Incorrect reset of the throttle valve position sensor

2 MIU system faults may be caused by loose connectors. Make sure that all connections have been correctly made.

Check the connections as follows:

A check that the terminals are not bent.

B check that the connectors have been properly connected.

C check whether the malfunction can be fixed by shaking the connector slightly.

3 Check the entire system before replacing the MIUIf the fault is fixed by replacing the MIU control unit, install the original control unit again and check if the fault occurs again.

4 Use a multimeter with an internal resistance of more than 10K Ohm /V when troubleshooting. Instruments that are not suitable might damage the MIU central control unit. Use instruments with definitions over 0.1V and 0.5 W , the precision must be greater than 2%.

---

1. Before fixing any part of the injection system, check to see if there are any registered faults. Do not disconnect the battery before checking for faults.

2. The fuel feed system is pressurised at 250 kPa (2.5 BAR). Before disconnecting the fast-release fitting of the fuel supply pipe, check that there are no naked flames. Do not smoke. Act with caution to avoid spraying fuel to your eyes.

3. When fixing electric components, operate with the battery connected only when actually required.

4. When functional checks are performed, check that the battery voltage is over 12V.

5. Before trying to start the vehicle, check to make sure there is at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.

6. If the vehicle is expected to remain unused for a long time, refill the tank up to a little over half the level. This will ensure the pump will be covered by fuel.

7. When washing the vehicle, be careful with the electric components and wiring.

8. When an ignition problem is detected, start the checks from the battery and the injection system connections.

9. Before disconnecting the MIU control unit connector, perform the following steps in the order shown:

- Set the switch to «OFF»
- Disconnect the battery

Failure to respect this norm may damage the control unit.

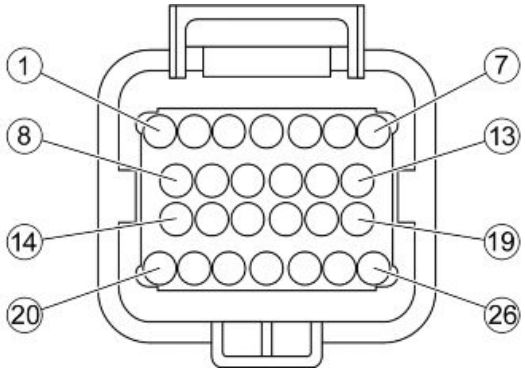
10. Do not invert the polarity when fitting the battery.

11. To avoid damage, only disconnect and reconnect the MIU system connectors if required. Before reconnecting, check that the connectors are dry.

12. When carrying out electric inspections, do not force the tester probes into the connectors. Do not take measurements not specifically foreseen by the manual.

13. At the end of every check performed with the diagnostic tester, protect the system connector with its cap. Failure to observe this precaution may damage the MIU control unit.
14. Before reconnecting the quick couplers of the power supply system, check that the terminals are perfectly clean.

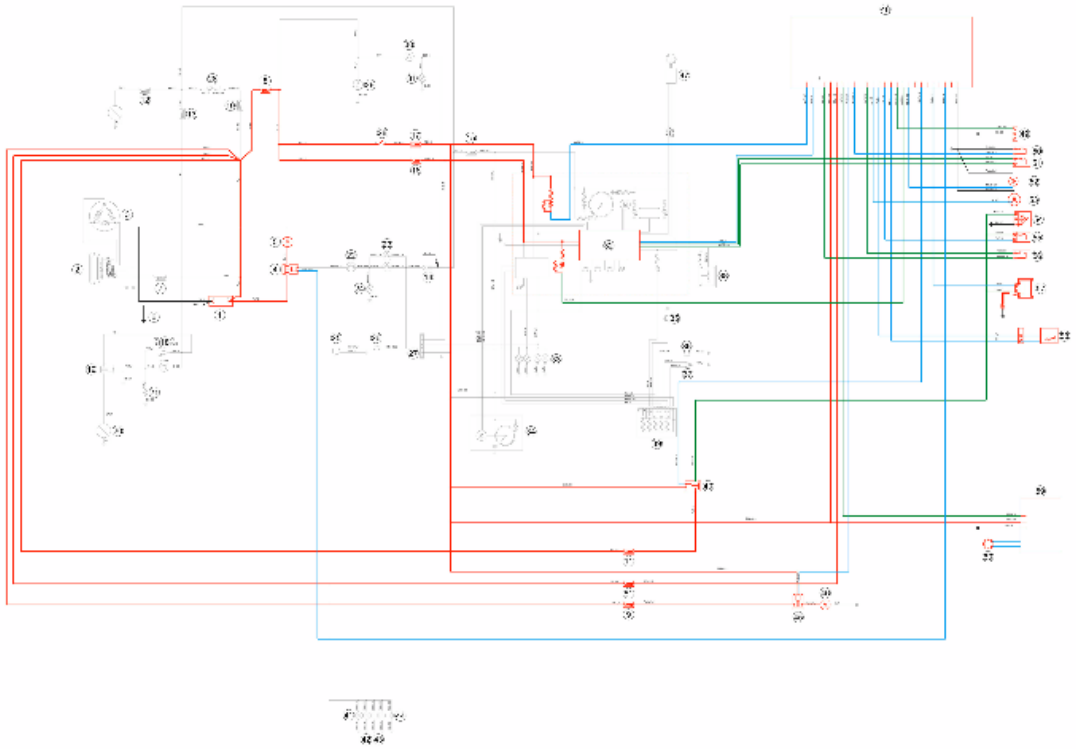
Terminals setup



TERMINAL LAYOUT

	Specification	Desc./Quantity
1	Injection telltale light	
2	Rpm indicator	
3	-	
4	- Lambda probe	
5	+ battery under permanent power supply	
6	+ Battery	
7	Immobilizer aerial	
8	Electric fan remote control	
9	Water temperature sensor	
10	-	
11	+ Lambda probe	
12	engine stop switch	
13	Engine speed sensor (+)	
14	Fuel injector	
15	Engine speed sensor (-)	
16	Diagnostics socket output	
17	Immobilizer LED	
18	Side stand	
19	-	
20	Injection load remote control	
21	-	
22	HV coil	
23	-	
24	Start up enabling	
25	-	
26	Ground lead	

EMS circuit diagram



KEY

1. Battery 12V - 14Ah

4. Starter solenoid

5. Starter motor

6. Engine ground

8. Fuses No. 02 - 15A

9. N. 03 - 15A Fuse

11. Fuses No. 05 - 10A

16. Fuses No. 10 - 7.5A

17. Fuses No. 11 - 7.5A

28. Ignition key contact

32. Instrument panel

40. Electronic control unit remote control switch

45. Radiator electric fan remote control

46. Radiator electric fan

48. Injection ECU

49. Diagnosis

50. Coolant temperature sensor for c.d.i.

51. Coolant sensor for instrument

52. Stand button

53. Engine stop switch

54. Fuel pump

55. Fuel injector

56. Lambda sensor

57. HV coil

58. Engine speed sensor

59. Decoder

60. Aerial

61. Fuses No. 12 - 7.5A

Troubleshooting procedure

Engine does not start

ENGINE DOES NOT START IF ONLY PULLED

Possible Cause	Operation
Immobiliser enabling signal	System not encoded System not efficient, repair according to the indications of the self-diagnosis
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor
Fuel system	Fuel in the tank Fuel pump activation Fuel pressure (low) Injector capacity (low)
Power to the spark plug	Shielded spark plug cap HV coil (secondary insulation)
Parameter reliability	Coolant temperature Distribution timing - injection ignition Intake air temperature
End of compression pressure	End of compression pressure

Starting difficulties

ENGINE STARTER PROBLEMS

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Starter speed	Starter motor and solenoid Battery Ground connections
End of compression pressure	End of compression pressure
Power to the spark plug	Spark plug Shielded cap HV coil

Possible Cause	Operation
	Speed-timing sensor Ignition advance
Fuel system	Fuel pressure (low) Injector capacity (low) Injector sealing (poor)
Correctness of the parameters	Coolant temperature Stepper throttle valve position intake air temperature (steps and actual opening) Cleaning of the auxiliary air pipe and throttle valve; air filter efficiency

Engine stops at idle

ENGINE DOES NOT IDLE/ IDLING IS UNSTABLE/ IDLING TOO LOW

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Ignition efficiency	Spark plug Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Engine does not rev down

ENGINE DOES NOT RETURN TO IDLING SPEED/IDLING SPEED TOO HIGH

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Ignition efficiency	Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Exhaust backfires in deceleration

EXHAUST BACKFIRES WHEN DECELERATING

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity
Exhaust system sealing (infiltrations)	Manifold - head Manifold - silencer silencer welding

Engine revs irregularly

ENGINE IRREGULAR PERFORMANCE WITH VALVE SLIGHTLY OPEN

Possible Cause	Operation
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing	Intake sleeve Filter box
Ignition system	Spark plug wear check
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
TPS reset successful	TPS reset successful
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe

Poor performance at full throttle

POOR ENGINE PERFORMANCE AT FULL POWER/ ENGINE IRREGULAR PERFORMANCE ON PICKUP

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor

Possible Cause	Operation
	Air temperature Coolant temperature Lambda probe
Spark plug power supply	Spark plug Shielded cap HV cable HV coil
Intake system	Air filter Filter box (sealing) Intake sleeve (sealing)
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Fuel system	Fuel level in the tank Fuel pressure Fuel filter Injector capacity

Engine knocking

PRESENCE OF KNOCKING (COMBUSTION SHOCKS)

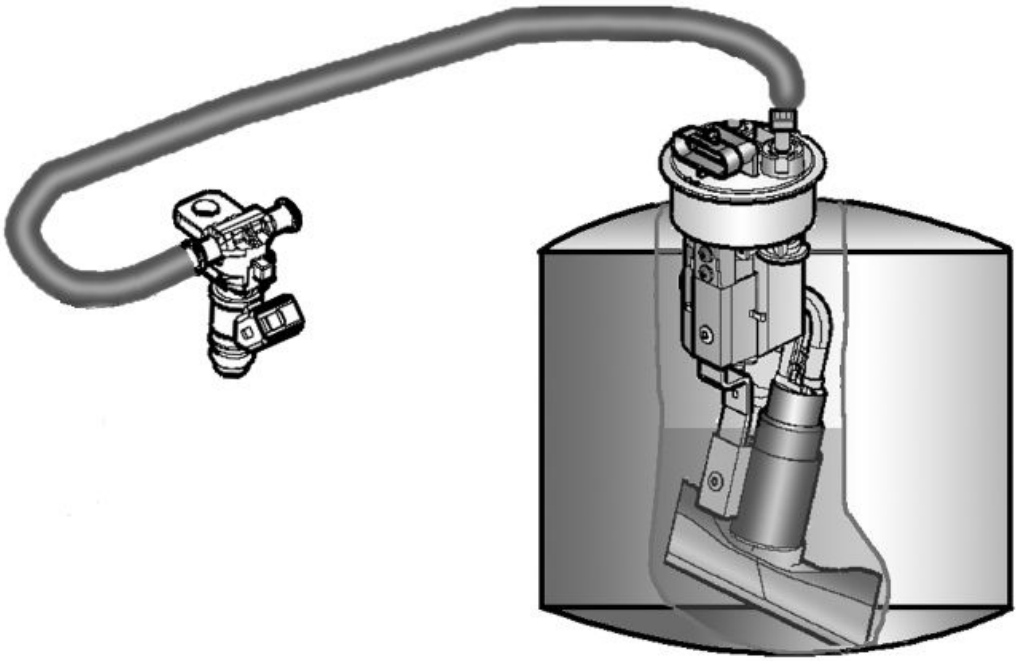
Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Intake system sealing	Intake sleeve Filter box
TPS reset successful	TPS reset successful
Fuel system	Fuel pressure Fuel filter Injector capacity Fuel quality
Selection of the cylinder base gasket thickness	Selection of the cylinder base gasket thickness

Fuel supply system

The fuel system circuit includes the electric pump, the filter, the pressure regulator, the electro-injector and the fuel delivery pipes.

The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

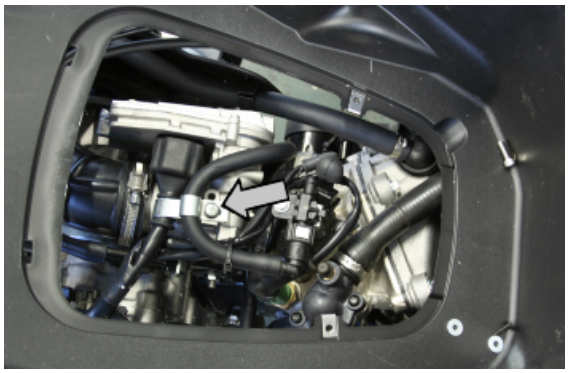
The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.



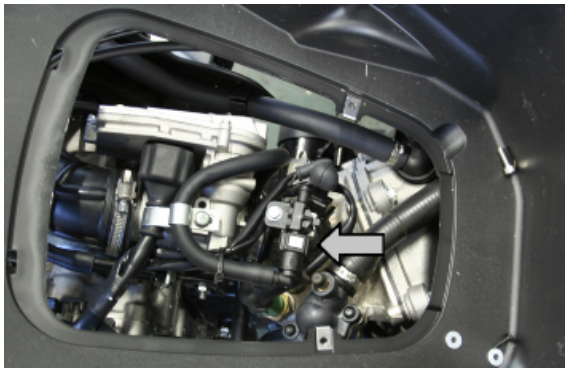
Removing the butterfly valve

Remove the helmet compartment.

Remove the fuel piping clamping screw indicated in the figure.

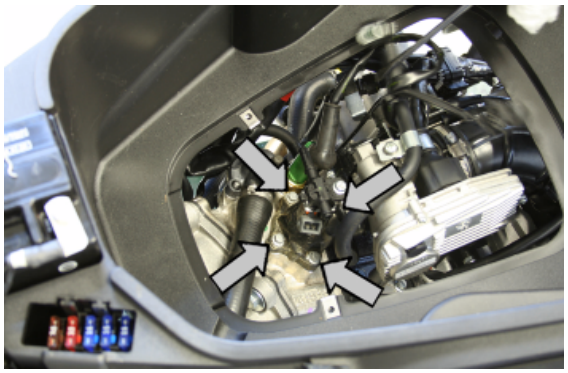


Remove the fast-release fitting from the injector support.

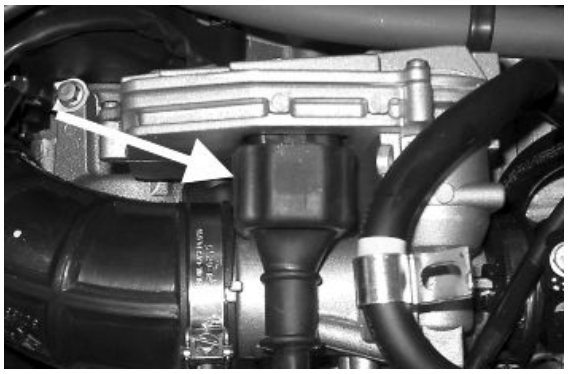


Remove the injector connector.

Remove the three screws fixing the manifold to the cylinder head and the clip fixing the throttle body to the manifold.



Remove the MIU ECU connector.

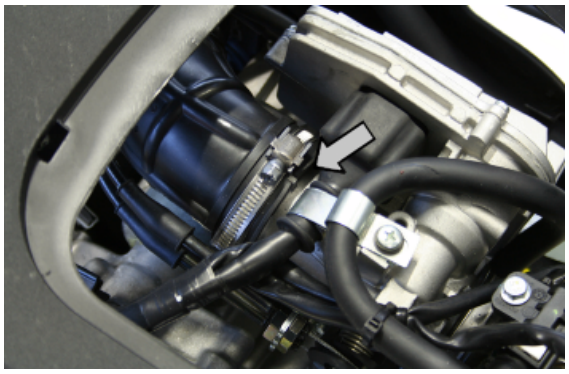


Remove the clip fixing the throttle body to the air cleaner bellows.

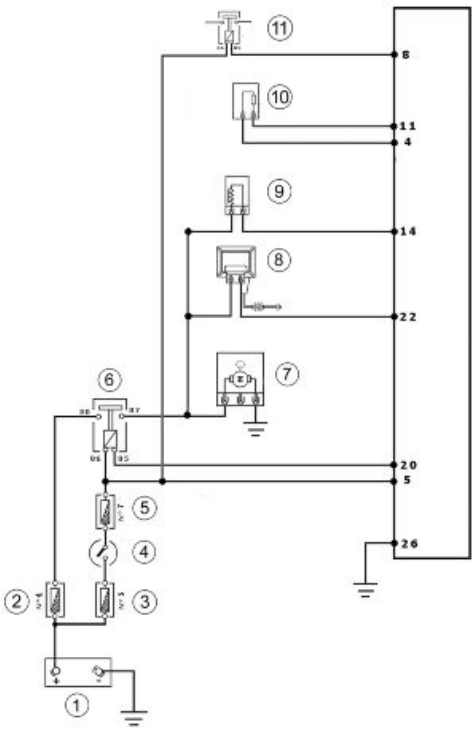
Remove the throttle control retainers as indicated in the photograph.

Refitting the butterfly valve

For refitting, carry out the removal operations but in reverse order paying particular attention to position the reference marks of the air cleaner sleeve on the throttle body as indicated in the photograph.



Pump supply circuit



INJECTION LOADS

	Specification	Desc./Quantity
1	Battery	12V-14Ah
2	Fuse	15 A
3	Fuse	15 A
4	Ignition key contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	HV coil	
9	Fuel injector	
10	Lambda Probe	
11	Electric fan remote control	

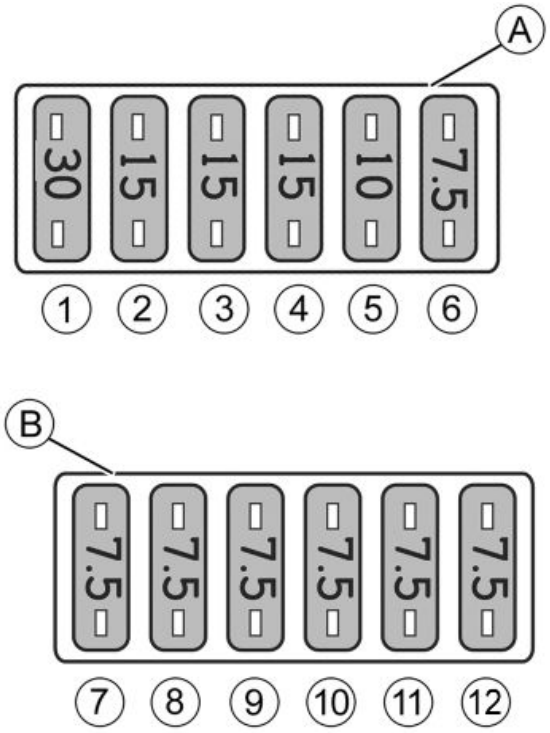
When switched to "ON", the fuel pump starts to rotate for two seconds and then stops. When the engine starts, in the presence of rpm timing signal the pump is continuously supplied.

ELECTRICAL DATA

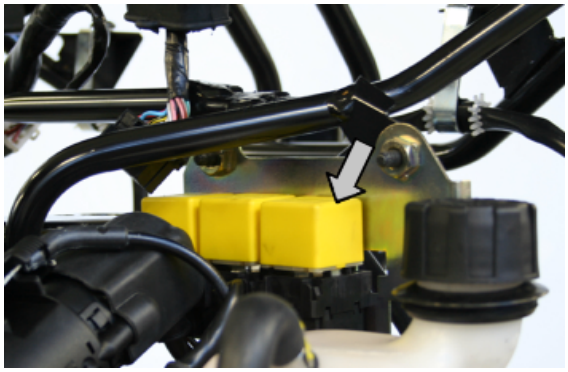
- Pump winding resistance ~ 1.5 Ohm
- Input current during regular operation 1.4 ÷ 1.8 A
- Input current to the closed hydraulic circuit ~ 2 A (to be checked with appropriate tool for fuel pressure control choking the circuit on the return pipe)

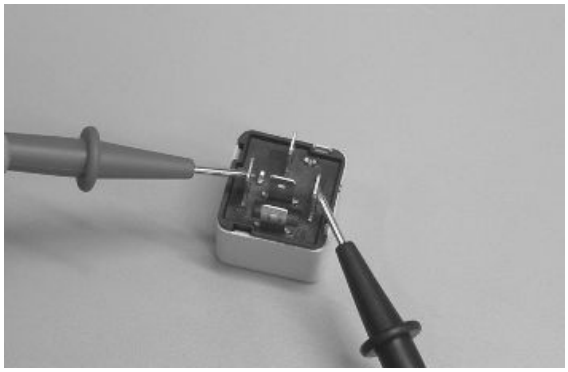
Check that the injection load 15A fuse No. 3 works properly.

Check that the 7.5A fuse No. 12 for live control unit power works properly.



Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

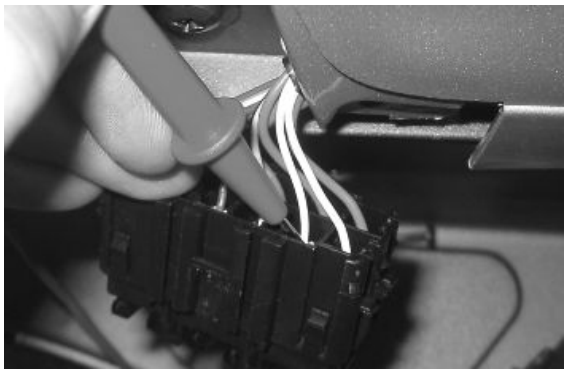


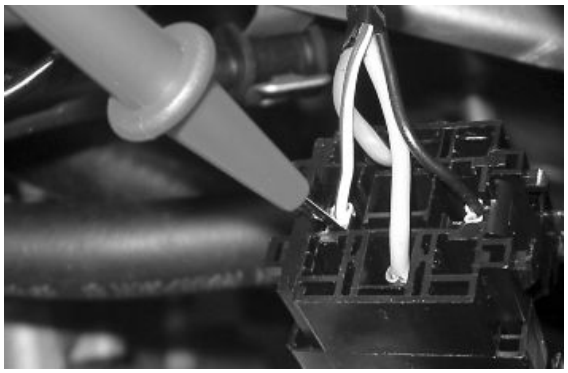


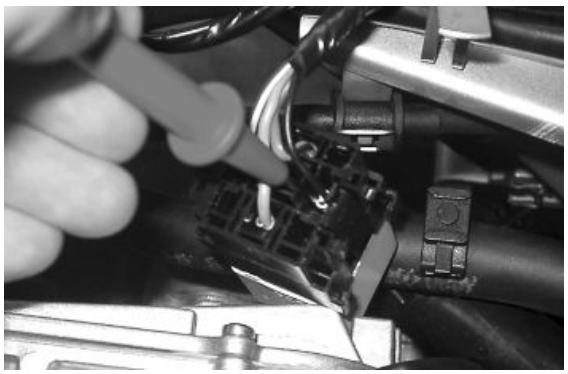
Check the power supply line of the injection load remote control energising coil: After switching to "ON", make sure there is battery voltage, for two seconds, between the black/white cable and black-violet cable of the remote control base. If there is not, check the continuity of the black/white cable between fuse block and the remote control base and of the black/violet cable between pin 20 of the control unit and the remote control base.

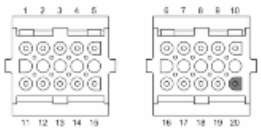
NOTE

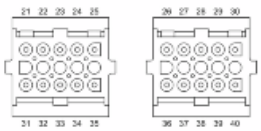
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).







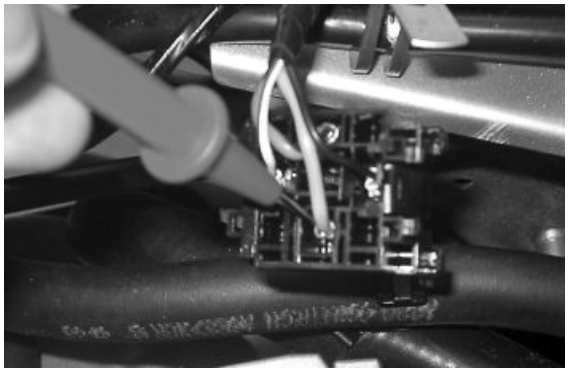

1 2 3 4 5
11 12 13 14 15
6 7 8 9 10
16 17 18 19 20

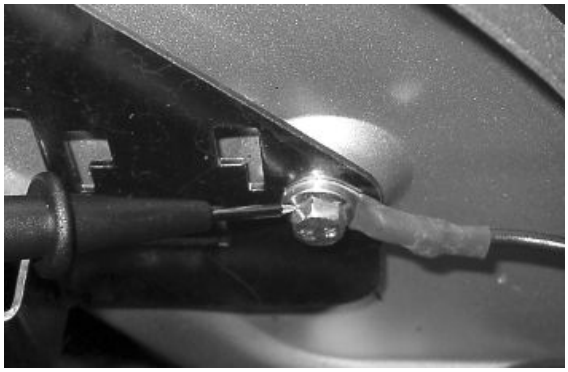

21 22 23 24 25
31 32 33 34 35
26 27 28 29 30
36 37 38 39 40

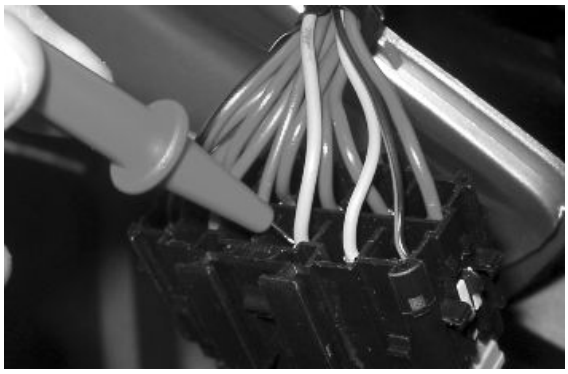
Check the presence of fixed voltage between the red/blue cable of the remote control base and earth. If not, check the continuity of the red/blue cable between the fuse box (No. 3 15A) and the remote control base.

NOTE

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).

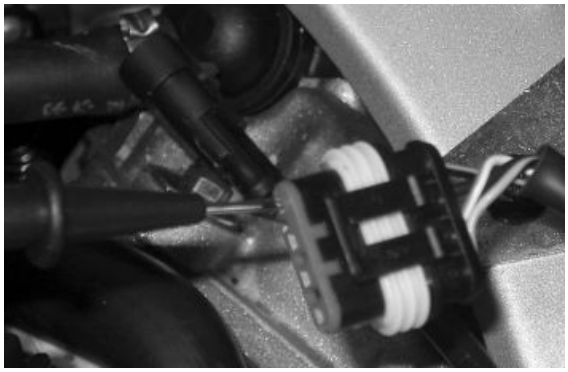






pump circuit 6

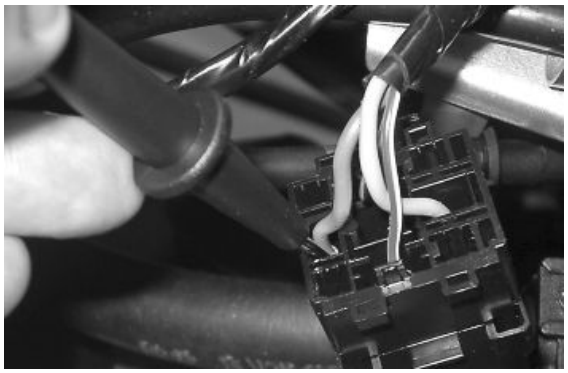
After switching to «ON» and for about 2 seconds, check that there is battery voltage between the Black-Green cable of the pump connector and the ground lead with the pump connector disconnected. Otherwise, check the continuity of the Black-Green cable between the pump connector and the remote control base.



Check the efficiency of the ground line of the fuel pump by measuring the continuity between the pump connector black cable, system side, and the ground.

If, when switching to "ON", the pump continues to turn after two seconds of activation, check, with the

control unit disconnected and the injection load remote control disconnected, that the Black-Purple cable (pin 20 on the interface wiring) is insulated from the ground.

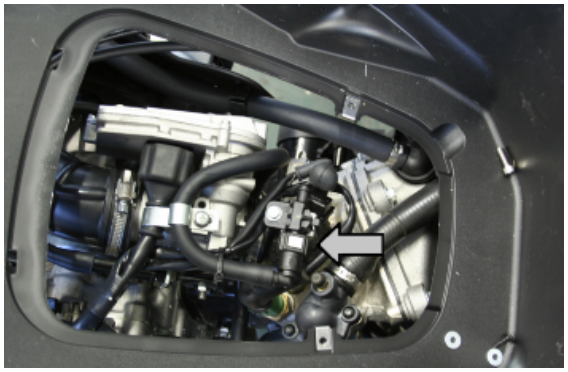


Specific tooling

020331Y Digital multimeter

Circuit leak test

Install the specific tool for fuel pressure control, with the pipe fitted with the pressure gauge on the indicated duct.



Check during regular operation by placing the appropriate tool between the pump and the injector. With the battery voltage> 12 V check that the fuel pressure is 2.5 BAR and that the input current is 1.4 to 1.8 A

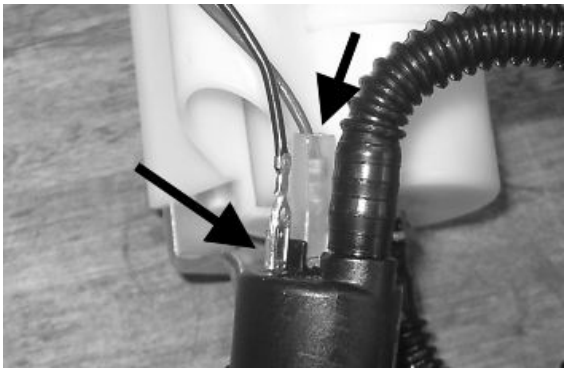
With the battery voltage > 12 V, check the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool. Get a graded burette with a flow rate of approximately 1 L. Rotate the pump using the active diagnoses of the palm top computer. Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 2.5 BAR. Check that within 15 seconds the pump has a flow rate of approx. 110 cm^3.

Specific tooling

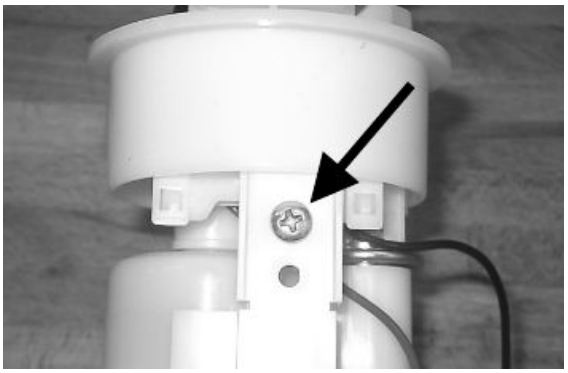
020480Y Petrol pressure check kit

Fuel filter check

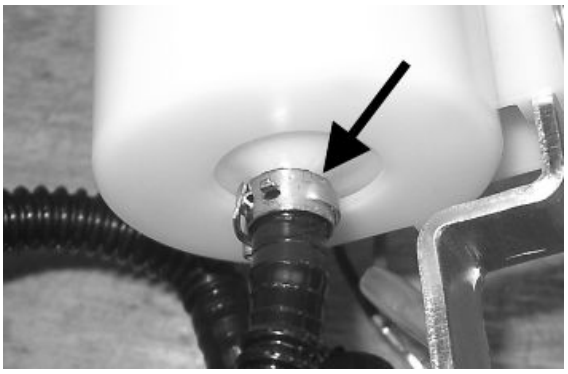
Disconnect the terminals from the electric pump



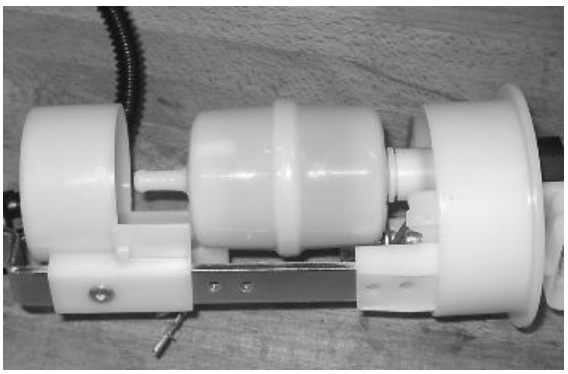
Remove the screw shown in the picture



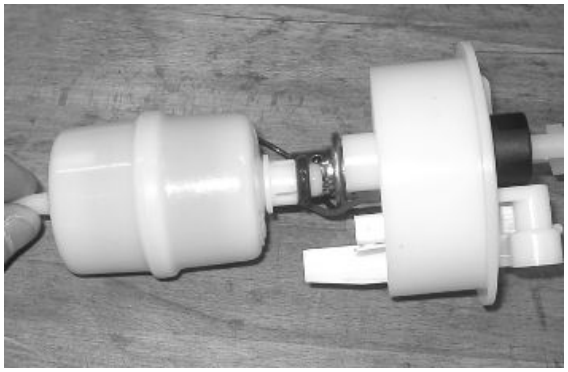
Remove the clip fixing the piping to the filter shown in the picture



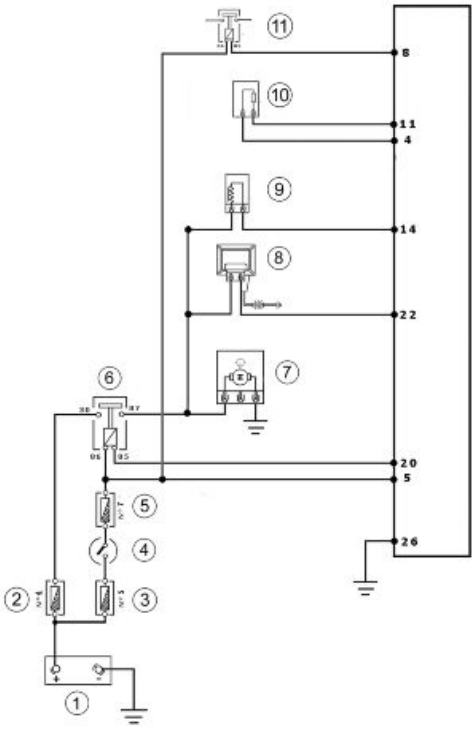
Separate the lower part of the pump mounting as shown in the picture.



Remove the filter from the pump mounting



Inspecting the injector circuit

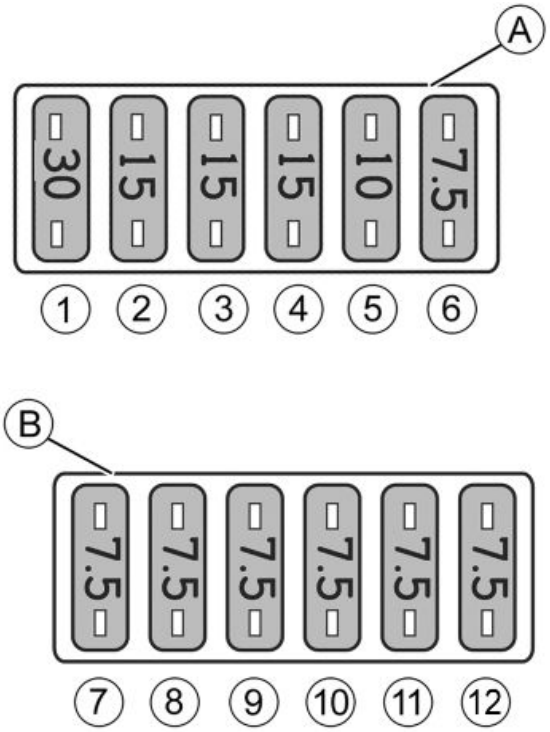


INJECTION LOADS

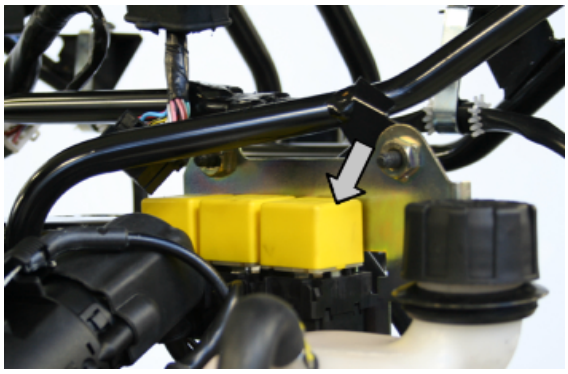
	Specification	Desc./Quantity
1	Battery	12V-14Ah
2	Fuse	15 A
3	Fuse	15 A
4	Ignition key contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	HV coil	
9	Fuel injector	
10	Lambda Probe	
11	Electric fan remote control	

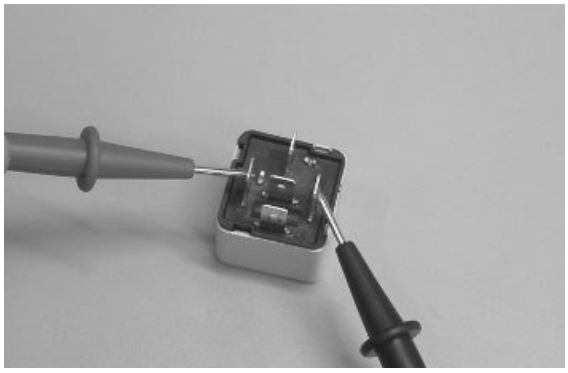
Checking the resistance at the injector ends: 14.5 ± 5% Ohm

Check that the injection load 15A fuse No. 3 works properly.
Check that the 7.5A fuse No. 12 for live control unit power works properly.

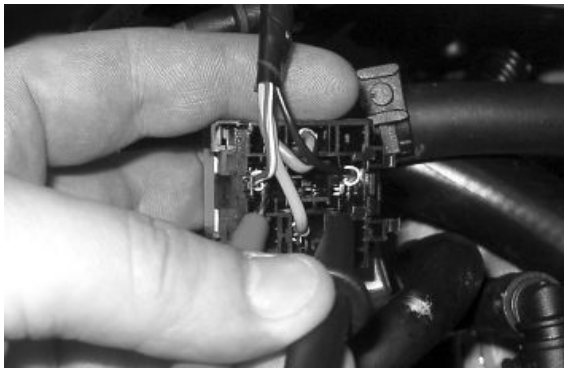


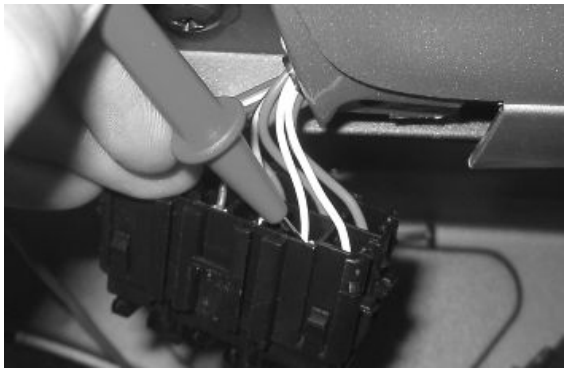
Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

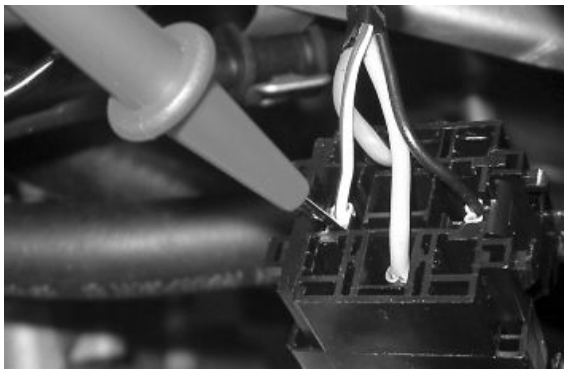




Check the power supply line of the injection load remote control energising coil: After switching to "ON", make sure there is battery voltage, for two seconds, between the black/white cable and black-violet cable of the remote control base. If there is not, check the continuity of the black/white cable between fuse block and the remote control base and of the black/violet cable between pin 20 of the control unit and the remote control base.

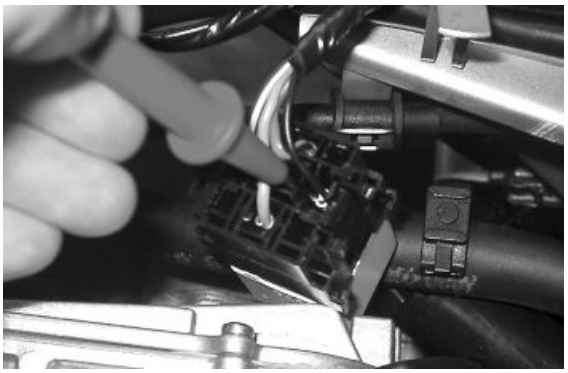


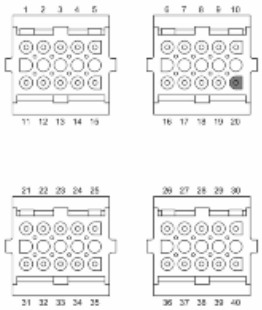




NOTE

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).

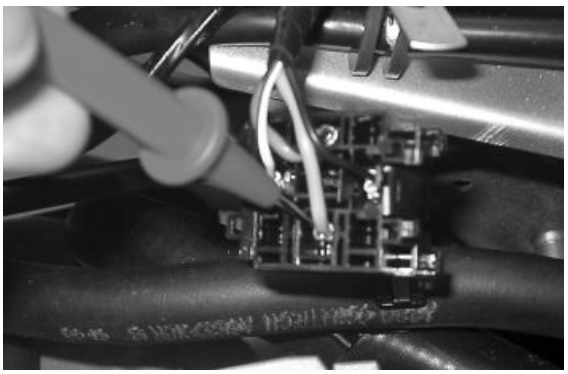


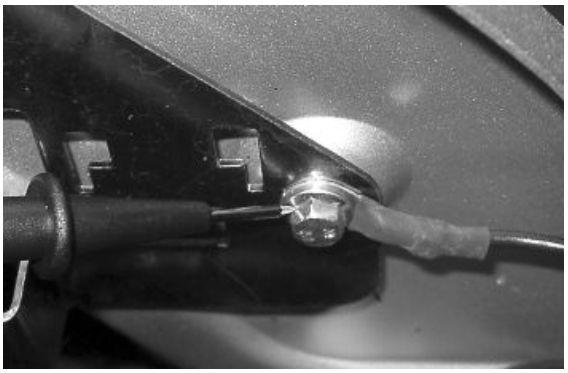


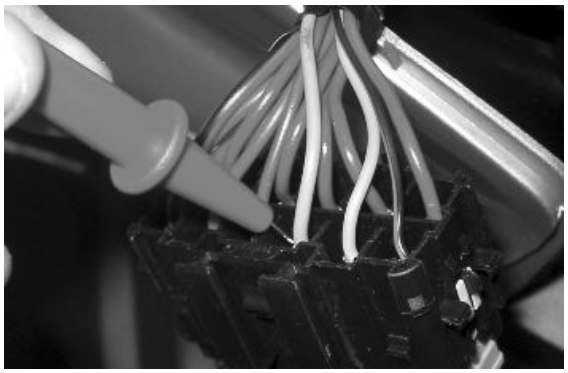
Check the presence of fixed voltage between the red/blue cable of the remote control base and earth. If not, check the continuity of the red/blue cable between the fuse box (No. 3 15A) and the remote control base.

NOTE

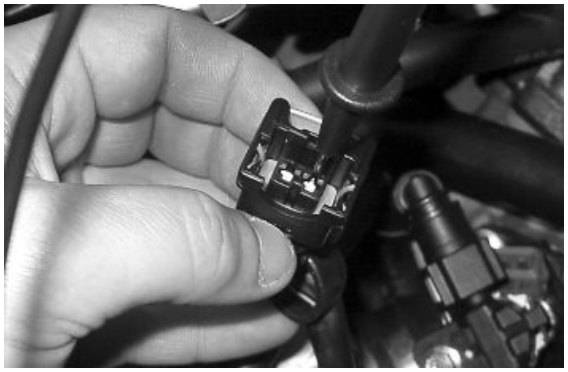
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).







With the control unit and the injector disconnected, check the continuity of the Red-Yellow cable between pin 14 of the interface wiring and the injector connector

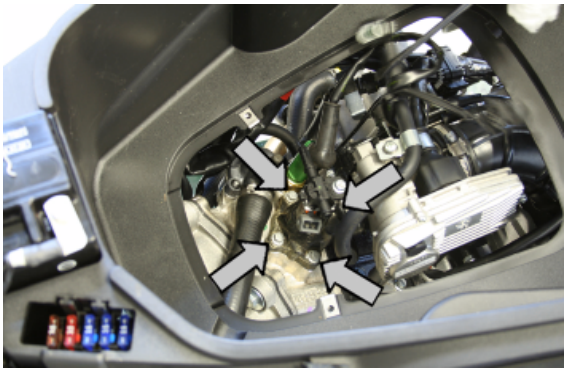


Switch to «ON» and check if there is voltage, with injector disconnected and control unit connected, between the Black-Green cable of the injector connector and the ground lead

With injector disconnected and the injector load solenoid disconnected, check the continuity of the Black-Green cable between the injector connector and solenoid base.

Inspecting the injector hydraulics

To carry out the injector check, remove the intake manifold by removing the three clamping screws at the head and the clip connecting the control unit to the manifold.



Install the appropriate tool for checking fuel pressure and position the manifold over a container graduated by at least 100 cm³. Connect the injector with the cable making up part of the supply for the injection tester. Connect the clamps of the cable to an auxiliary battery. Activate the fuel pump with the active diagnosis. Check that, within fifteen seconds, approximately 40 cm³ of fuel is dispensed with an adjustment pressure of approximately 2.5 BAR.

Specific tooling

020480Y Petrol pressure check kit

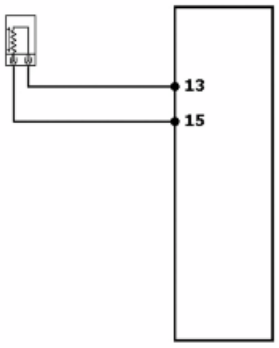
Proceed with the injector seal test.
Dry the injector outlet with a blast of compressed air. Activate the fuel pump. Wait for one minute, making sure there are no leaks coming from the injector. Slight oozing is normal.
Value limit = 1 drop per minute

Components location

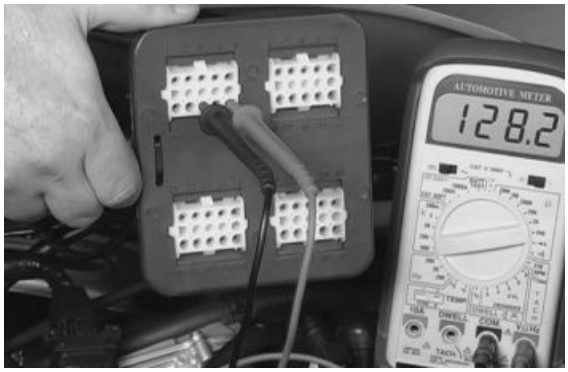
INJECTION COMPONENTS

	Specification	Desc./Quantity
1	Throttle body and electronic injection control unit (MIU)	
2	Fuel injector	
3	Diagnostics socket connector	
4	Injection load remote control	
5	Electric fan	
6	Fuel pump	
7	Lambda Probe	
8	Engine Speed sensor	
9	HV coil	
10	Water temperature sensor	

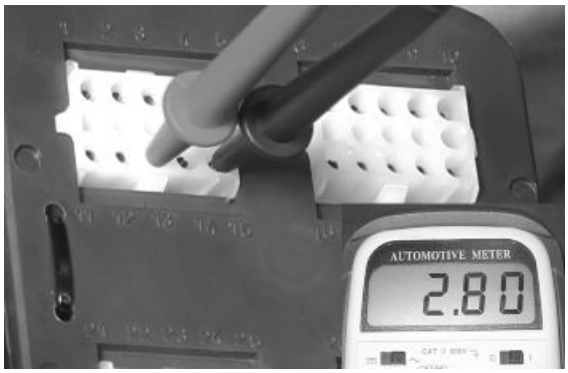
Tachometer



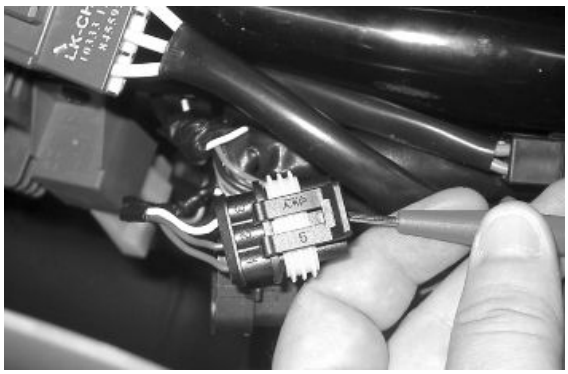
With wiring disconnected from the control unit and connected to the system, check that the sensor resistance between pins 13 - 15 is between 100 and 150 Ohm at an engine temperature of approximately 20°



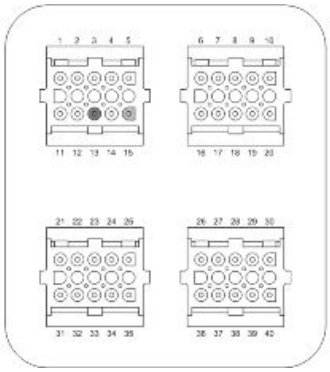
Disconnect the fuel pipe connector. Start up the engine and wait for it to stop. With the wiring connected to the control unit and system try to start up the engine and check that the voltage between pins 13 and 15 is around 2.8 V



With the interface cabling disconnected from the control unit, check for continuity between pin 13 and the red cable of the rev sensor connector and between pin 15 and the white cable of the rev sensor connector.



With the revolution sensor connector disconnected and interface wiring disconnected from the control unit, check that the red and white cables (pins 13 - 15) are isolated from each other and insulated from the ground connection.

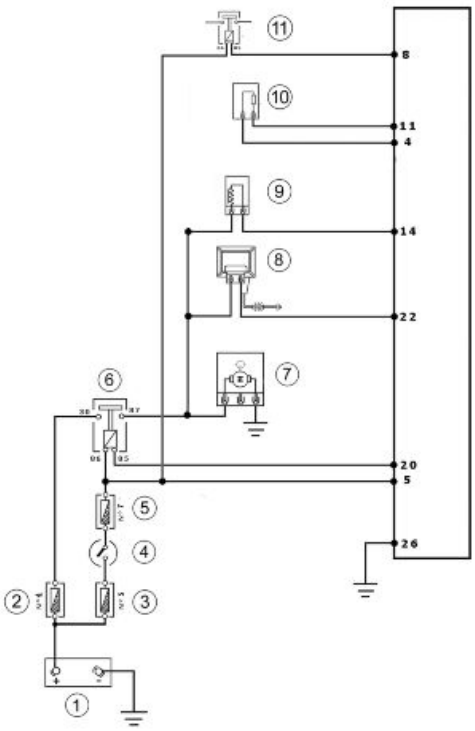


Specific tooling

020481Y Control unit interface wiring

020331Y Digital multimeter

HT coil



INJECTION LOADS

	Specification	Desc./Quantity
1	Battery	12V-14Ah
2	Fuse	15 A
3	Fuse	15 A
4	Ignition key contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	HV coil	
9	Fuel injector	
10	Lambda Probe	
11	Electric fan remote control	

The combined ignition/injection system is a high-efficiency induction system.

The control unit manages two significant parameters:

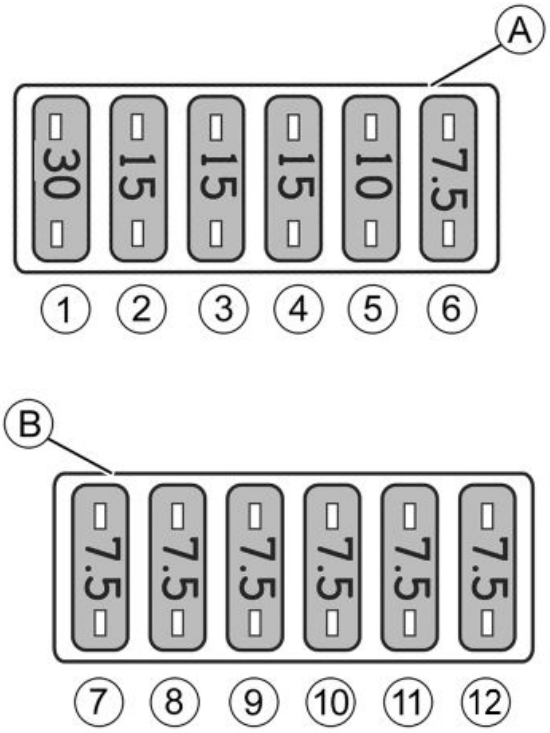
- Ignition advance

This is optimised at once according to the engine revs, engine load, temperature and ambient pressure.
With idle engine, it is optimised to obtain the stabilisation of the speed at 1450 ± 50 R/1'.
- Magnetisation time
The coil magnetisation time is controlled by the control unit. The power of the ignition is increased during the engine start-up phase.
The injection system recognises the 4-stroke cycle so ignition is only commanded in the compression phase.

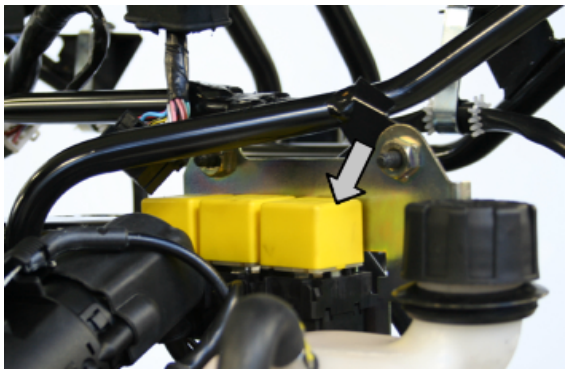
Specific tooling

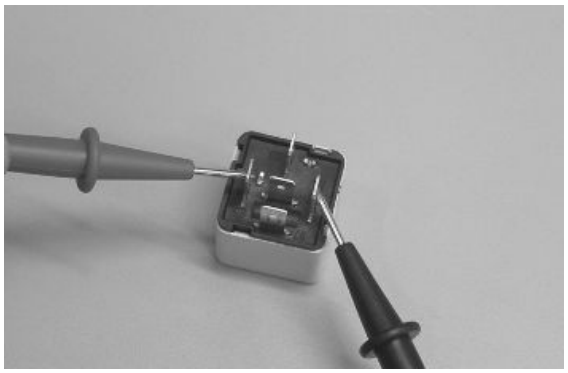
020331Y Digital multimeter

Check that the injection load 15A fuse No. 3 works properly.
Check that the 7.5A fuse No. 12 for live control unit power works properly.



Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

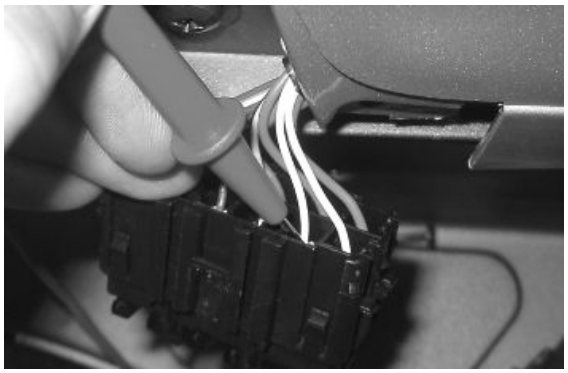


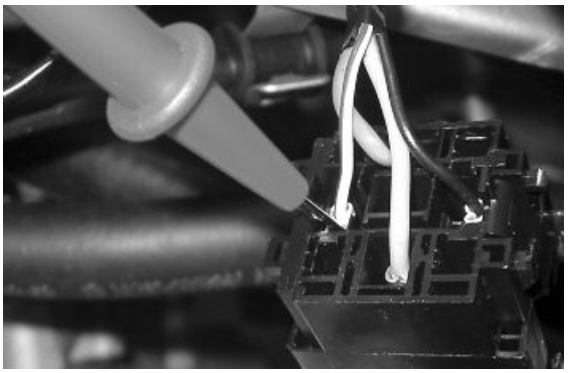


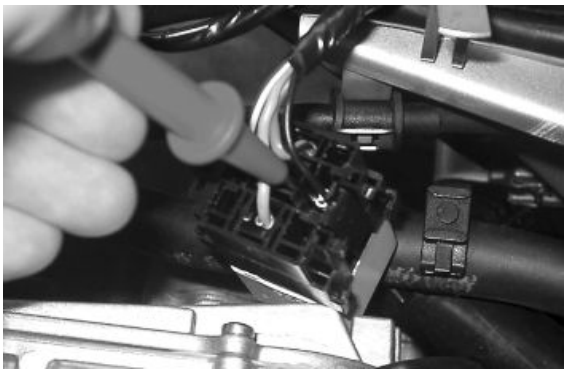
Check the power supply line of the injection load remote control energising coil: After switching to "ON", make sure there is battery voltage, for two seconds, between the black/white cable and black-violet cable of the remote control base. If there is not, check the continuity of the black/white cable between fuse block and the remote control base and of the black/violet cable between pin 20 of the control unit and the remote control base.

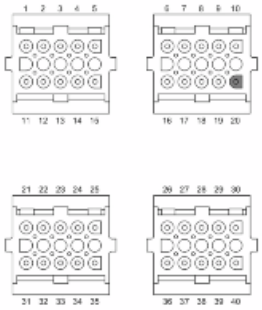
NOTE

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).





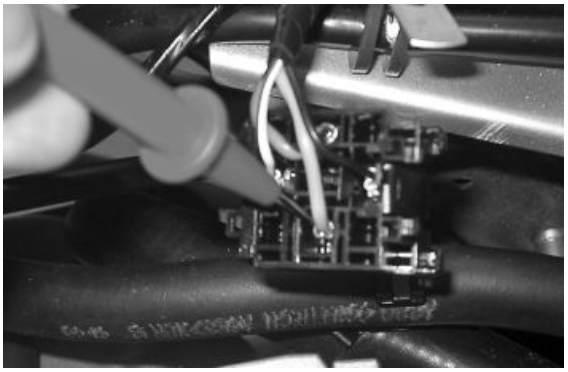


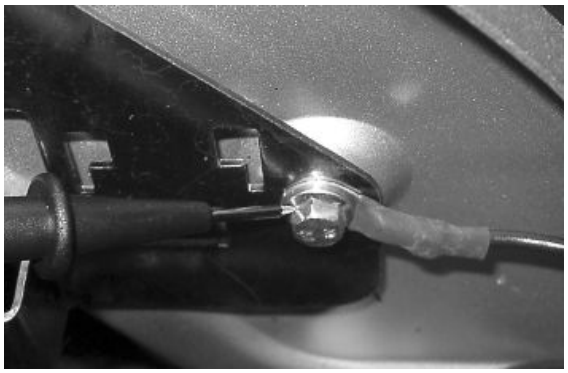


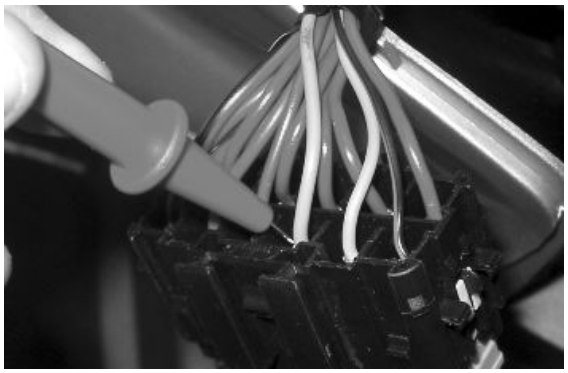
Check the presence of fixed voltage between the red/blue cable of the remote control base and earth. If not, check the continuity of the red/blue cable between the fuse box (No. 3 15A) and the remote control base.

NOTE

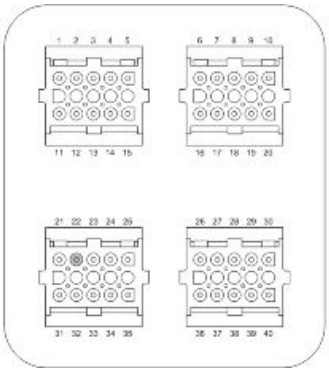
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).





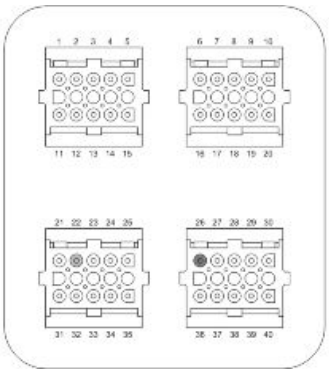


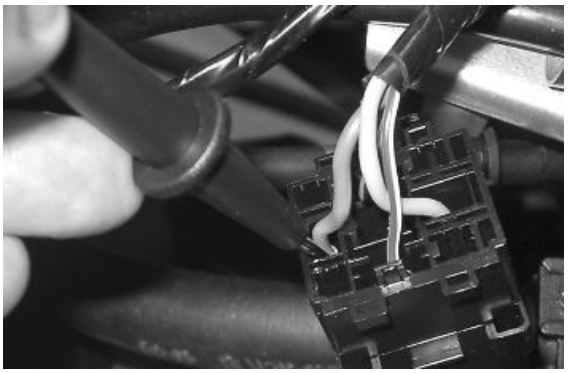
Check there is voltage between pins 22 and 26 of the interface wiring for around two seconds when switching to «**ON**».



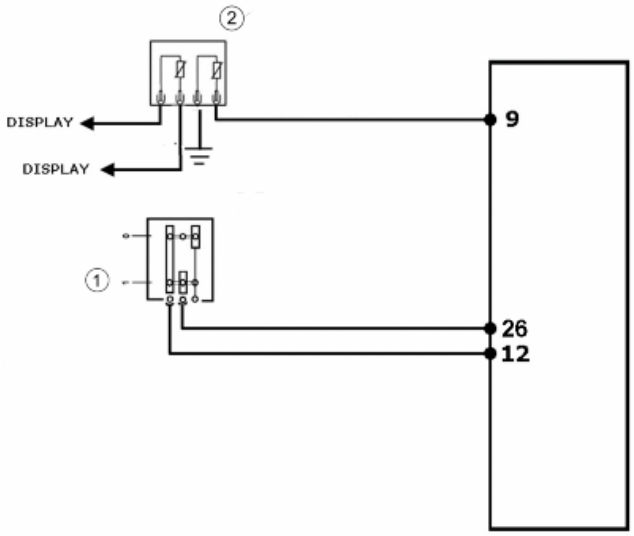
Check the resistance of the primary coil between pin 22 of the interface wiring and the green black cable of the injection load solenoid base with the control unit disconnected and the solenoid disconnected.

Resistance of the primary = 0.5 ± 8% Ohm





Coolant temperature sensor



TEMPERATURE SENSOR 1

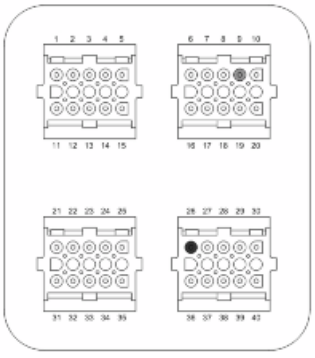
	Specification	Desc./Quantity
1	engine stop switch	
2	Water temperature sensor	

With the control unit side connector disconnected and the coolant temperature sensor connector connected, check the resistance between pins 9 and 26 in relation to the engine temperature.

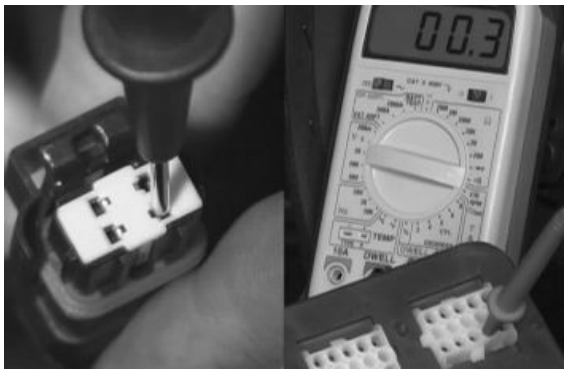
20° = 2500 ± 100 Ω

80° = 308 ± 6 Ω

With the control unit side connector disconnected and the coolant temperature connector discon-



nected, check the insulation between the two light blue/green and pink/yellow cables



Zeroing the throttle

Resetting the throttle valve position signal (TPS reset)

The MIU control unit is supplied with a throttle valve position sensor that is pre-calibrated.

Pre-calibration entails regulating the minimum opening of the throttle valve to obtain a certain flow of air under pre-set reference conditions.

Pre-calibration ensures optimal air flow to control idling.

This regulation must not be tampered with in any way whatsoever.

The injection system will complete the management of the idling through the Stepper motor and the variation of the ignition advance.

The throttle body after the pre-calibration has an opened valve with an angle that can vary depending on the tolerances of the machining of the pipe and the valve itself.

The valve position sensor can also assume various fitting positions. For these reasons the mV of the sensor with the valve at idle can vary from one throttle body to another.

To obtain the optimum fuel mixture, especially at small openings of the throttle valve, it is essential to match the throttle body with the control unit following the procedure known as TPS resetting.

With this operation we inform the control unit, as the starting point, of the mV value corresponding to the pre-calibrated position.

To reset, proceed as follows.

Connect the diagnostic tester.

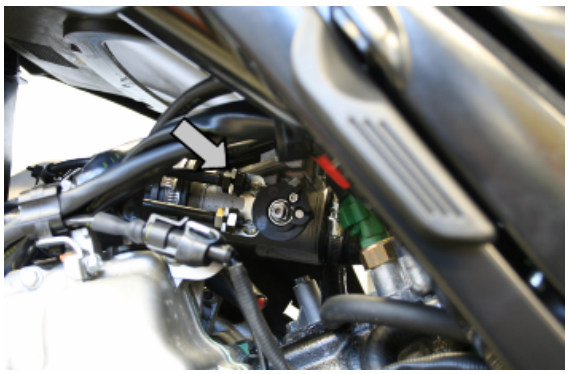
Switch to «**ON**».

Select the functions of the diagnostic tester on «**TPS RESET**».

Specific tooling

020680Y Diagnosis Tool

Make sure that the throttle valve with the control is supporting the stop screw.



Guaranteeing that this position will be kept, send a confirmation for the TPS reset procedure.

Reset should be performed in the following cases:

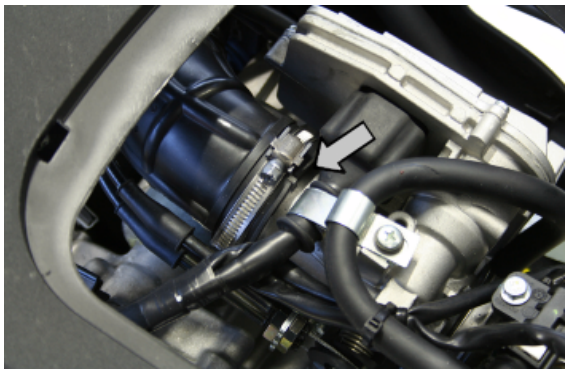
- on first fitting.

- if the injection control unit is replaced.

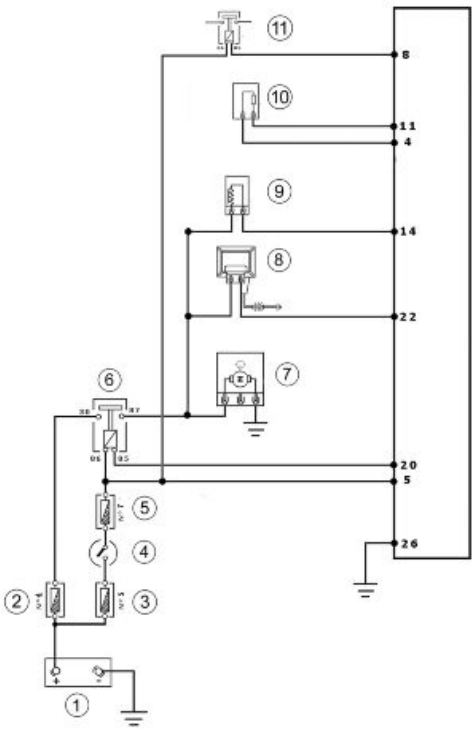
NOTE

THE TPS RESET PROCEDURE MUST NOT BE CARRIED OUT WITH A USED THROTTLE BODY BECAUSE POSSIBLE VALVE WEAR AND STOP WEAR FOR THE MINIMUM OPENING MAKE THE AIR FLOW DIFFERENTLY FROM THAT OF PRE-CALIBRATION.

Given that the TPS resetting is also done when the control unit is replaced, place the control unit - filter box bellows at 45° during the refitting operation as shown in the picture.



Lambda probe



INJECTION LOADS

	Specification	Desc./Quantity
1	Battery	12V-14Ah
2	Fuse	15 A
3	Fuse	15 A
4	Ignition key contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	HV coil	
9	Fuel injector	
10	Lambda Probe	
11	Electric fan remote control	

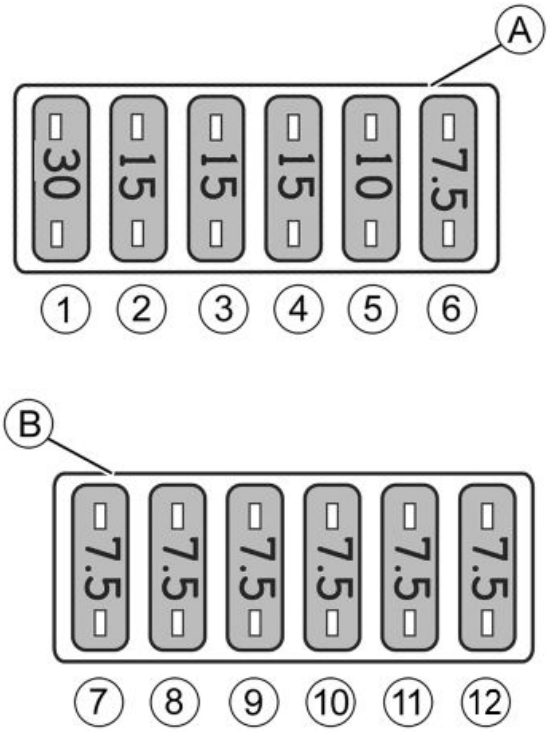
The lambda probe or oxygen sensor is a sensor which provides information about the oxygen content in the exhaust fumes. The signal generated is not of the proportional but of the ON/OFF type, i.e. whether there is oxygen or not. The probe is positioned on the exhaust manifold before the catalytic converter in an area where the gas temperature is always high. The temperature at which the probe works is at least 350°C at 600°C and it has a reaction time of just 50 milliseconds. The signal generated passes from a high value to a low one with a mixture with lambda =1.

Specific tooling

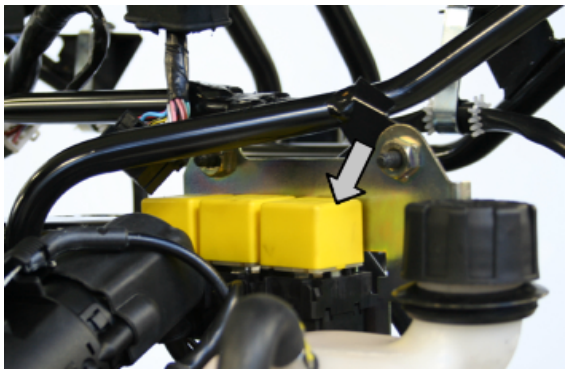
020481Y Control unit interface wiring

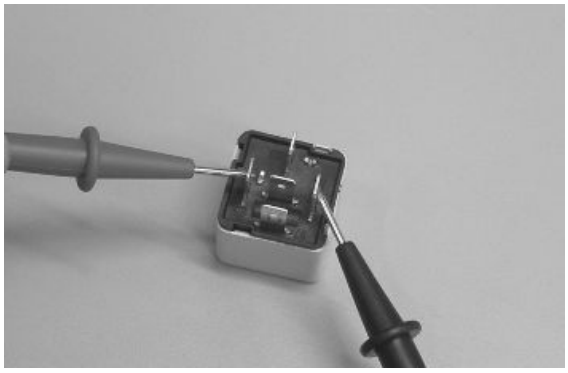
020331Y Digital multimeter

Check that the injection load 15A fuse No. 3 works properly.
Check that the 7.5A fuse No. 12 for live control unit power works properly.

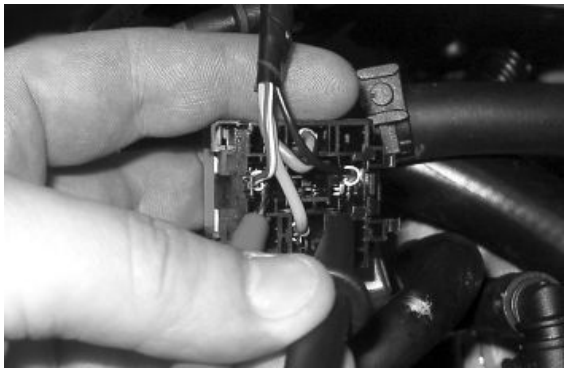


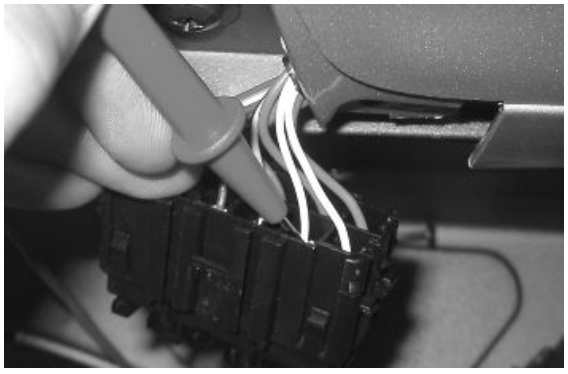
Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

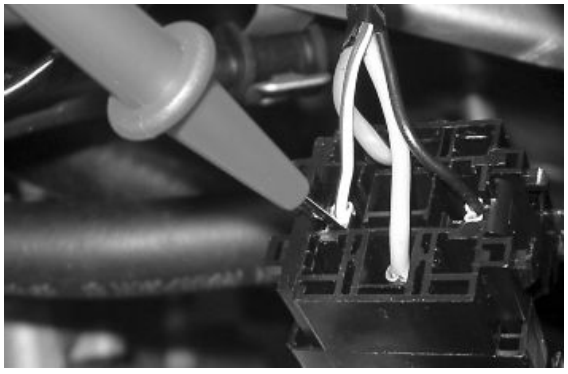




Check the power supply line of the injection load remote control energising coil: After switching to "ON", make sure there is battery voltage, for two seconds, between the black/white cable and black-violet cable of the remote control base. If there is not, check the continuity of the black/white cable between fuse block and the remote control base and of the black/violet cable between pin 20 of the control unit and the remote control base.

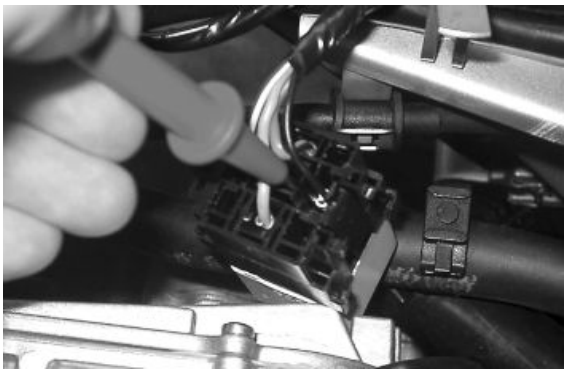


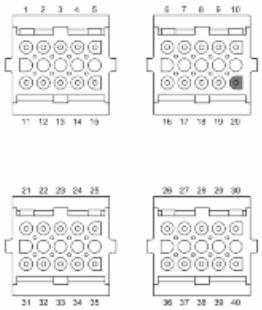




NOTE

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).

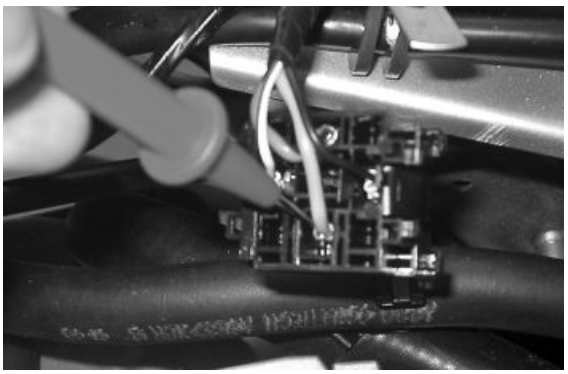


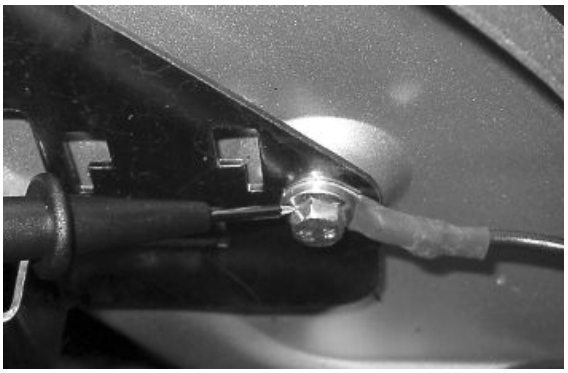


Check the presence of fixed voltage between the red/blue cable of the remote control base and earth. If not, check the continuity of the red/blue cable between the fuse box (No. 3 15A) and the remote control base.

NOTE

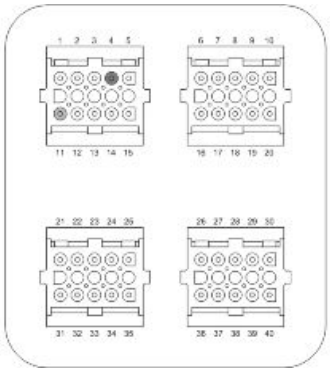
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).



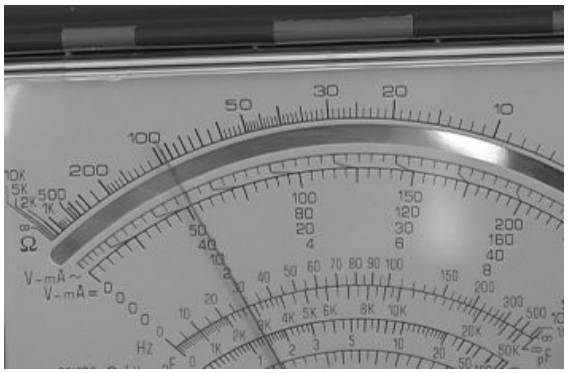


SIGNAL CONTROL

Install the electronic control unit interface wiring.
Start the engine and warm up until the electric fan switches on.
Use an analogue multimeter with a direct voltage scale measuring down to 2 V.
Place the tips of the multimeter between pins 4 (-) and 11 (+)



With the engine running at idle speed, check that the voltage oscillates between 0V and 1V
With the throttle valve completely open, the voltage is approx. 1V.
During the closing phase, the voltage is approx. 0V.
If the voltage remains constant, the sensor may be damaged. Remove the sensor and check that there are no oil or carbon deposits inside it..



INDEX OF TOPICS

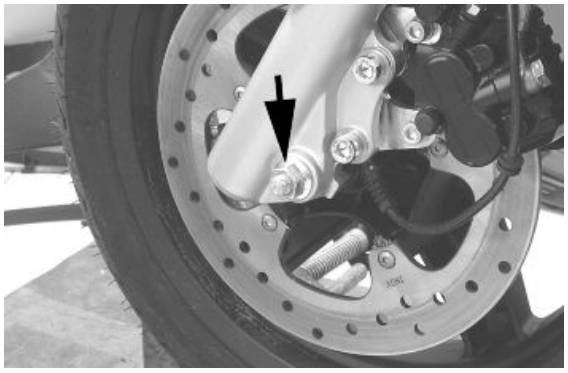
SUSPENSIONS	SUSP

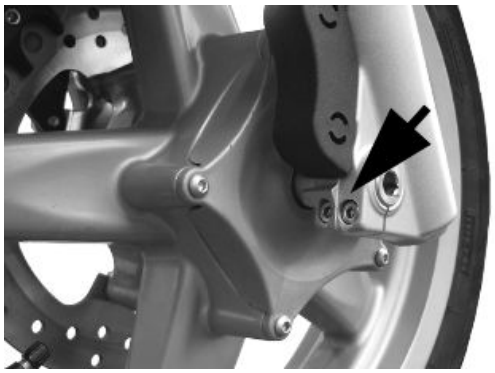
This section is dedicated to operations that can be carried out on the suspensions.

Front

Removing the front wheel

- Remove the fixing nut from the wheel axle on the left side of the vehicle.
- Loosen the two screws fixing the wheel axle clamp and remove the clamp.

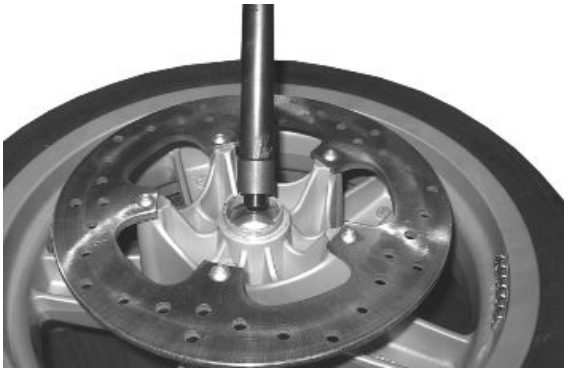




Front wheel hub overhaul

Check that the wheel bearings do not show signs of wear.
If you have to replace the wheel bearings, proceed as follows:
- Remove the two bearings on the brake disc side using pliers 14 and the special bell 9.
- Remove the internal spacer.

- Support the front wheel with two wooden shims that make it possible to avoid scratching in the case of contact with the rim.
- Insert the punch (consisting of adaptor handle, 24 mm adaptor and 15 mm guide) from the brake disc side to permit the removal of the opposite side bearing and the spacer bushing.



Specific tooling

020376Y Adapter handle

020456Y Ø 24 mm adaptor

020412Y 15-mm guide

- Heat the bearing seat on the side opposite the brake disc with the heat gun.

- Insert the bearing using the punch consisting of adaptor handle, 40x37 mm adaptor and 15 mm guide, and take it to the stop.

- Reinsert the spacer bushing on the brake disc side using the appropriate tool and take it to the stop.

Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020412Y 15-mm guide

020201Y Spacer bushing driving tube

- Refit the cap and tighten the five fixing screws.

- Turn over the wheel and insert the internal spacer with the part fitted with the Seeger ring facing the bearing on the brake disc side.

- Heat the bearing seat on the side the brake disc with the heat gun.

2 - Insert the two bearings one at a time using the punch consisting of adaptor handle, 32x35 mm adaptor and 15 mm guide, and take it to the stop.

Specific tooling

020376Y Adapter handle

020357Y 32x35-mm Adaptor

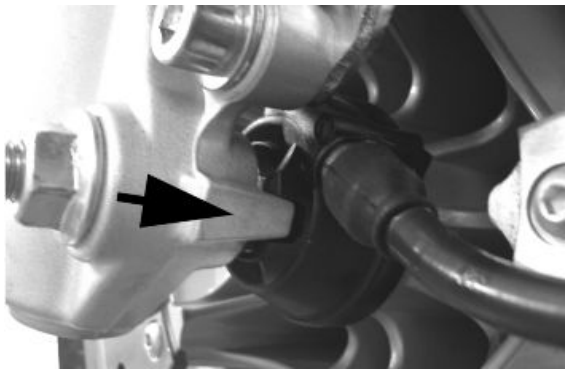
020412Y 15-mm guide

Refitting the front wheel

- When refitting, pay attention in repositioning the odometer drive correctly.

Locking torques (N*m)

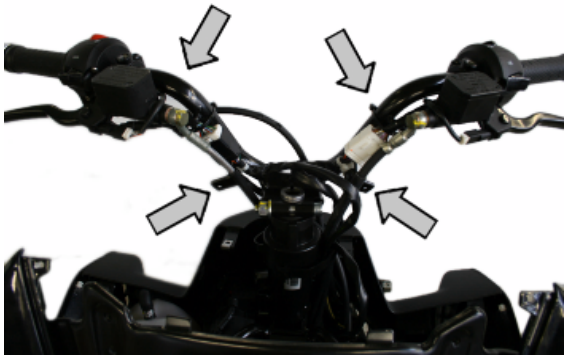
Wheel axle nut 45 to 50 Wheel axle clamp screws 6 - 7 Nm



Handlebar

Removal

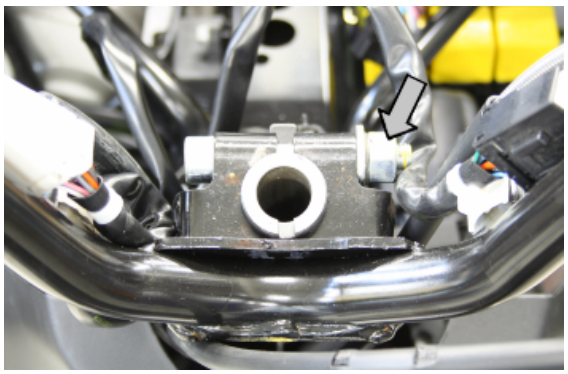
- Remove the two handlebar covers and the upper part of the shield back plate proceeding as indicated in the «Bodywork» chapter.
- Remove the handlebar wiring retaining straps and disconnect the electric connectors from the brake levers.
- Unscrew the fittings, then remove the front and rear brake pump piping.
- Remove the flexible transmissions of the throttle grip and remove the throttle control.



- Unscrew the indicated nut, collect the washers and remove the fixing pin to the steering tube.
- Remove the handlebar by pulling it upwards.

NOTE

IF THE HANDLEBAR IS BEING REMOVED TO REMOVE THE STEERING, IT IS ONLY NECESSARY TO TILT THE HANDLEBAR FORWARD ONTO THE FRONT PART OF THE VEHICLE WITHOUT REMOVING THE PARTS FITTED SO AS TO AVOID DAMAGING THE SHAFTS.



Refitting

Carry out the removal operations but in the reverse order, observing the prescribed tightening torque.

Locking torques (N*m)

Handlebar fixing screw 50 ÷ 55

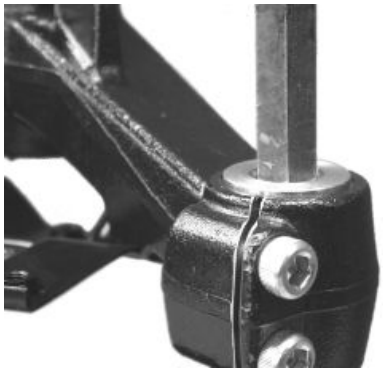
Front fork

Removal

See also

Overhaul

- Support the fork in a vice.
- Loosen the two tightening screws of the stem supporting clamp.
- Unscrew the stem closing cap and slide off the complete fork leg from the corresponding support.

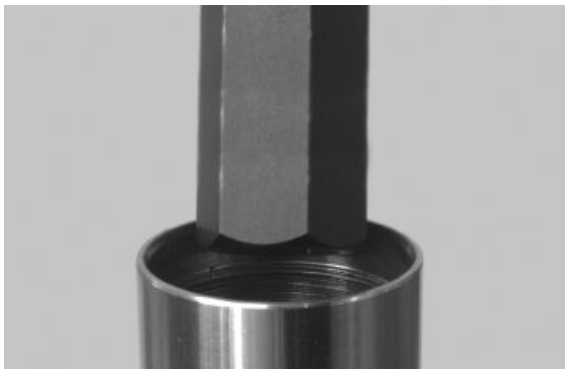


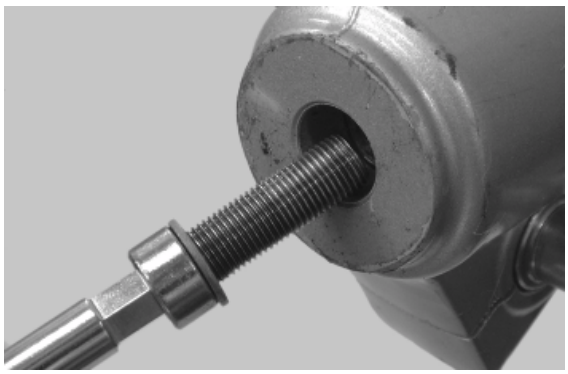
CAUTION

THE STEM CLOSING CAP KEEPS THE MAIN SPRING PRE-LOADED. KEEP THE CAP PROPERLY FITTED DURING THE REMOVAL FINAL STAGE TO AVOID ACCIDENTS.

- Support the fork leg properly, remove the main spring and drain off the fork leg oil.

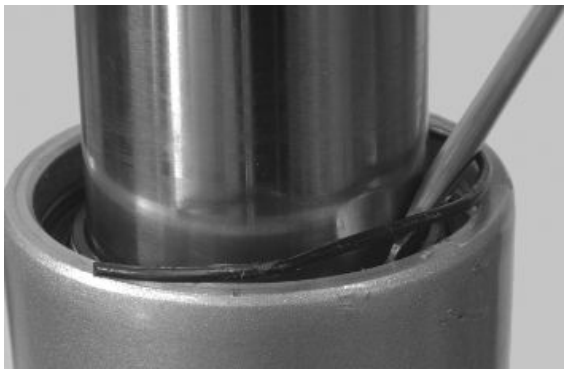
- Remove the hydraulic rod fixing screw with the corresponding sealing gasket:
- With a 19-mm hexagonal spanner, lock hydraulic rod rotation.
- Undo the fixing screw and collect the copper washer.





- Remove the stem dust guard with a screwdriver.

- Remove the circlip retaining the oil seal.



- Take out the stem.

- Check there are no signs of wear or seizing between the stem and the fork leg. Otherwise, replace the damaged parts.

Characteristic

Maximum fork leg diameter

35.10 mm

Minimum stem diameter

34.90 mm

- Take out the oil seal using the appropriate tools.
- Fit the tie rod into the oil seal.
- Insert in sequence the two half-rings per Ø 35-mm stems.

Specific tooling

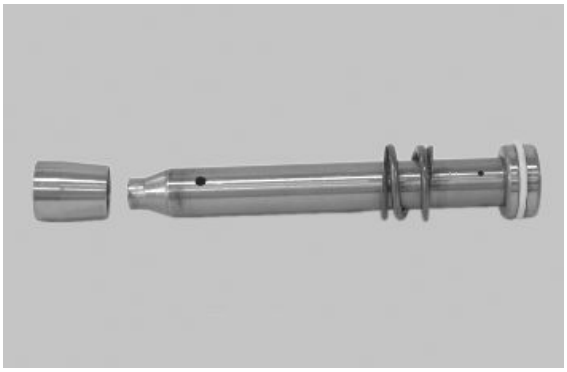
020487Y Fork oil seal extractor

- Hold the tie rod manually so that it does not fall into the fork leg and/or that both half-rings are not in their position.
- Fit the bell.
- Tighten the nut until it stops.
- Act on the tool until the oil seal is completely removed.

Specific tooling

020487Y Fork oil seal extractor

- Remove the hydraulic rod with the corresponding sealing gasket, the spring and the stop bushing.

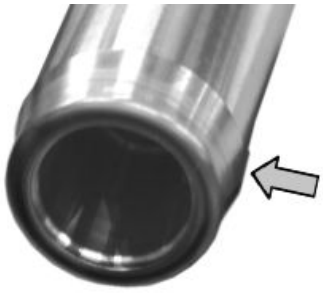


COMPONENT CHECK

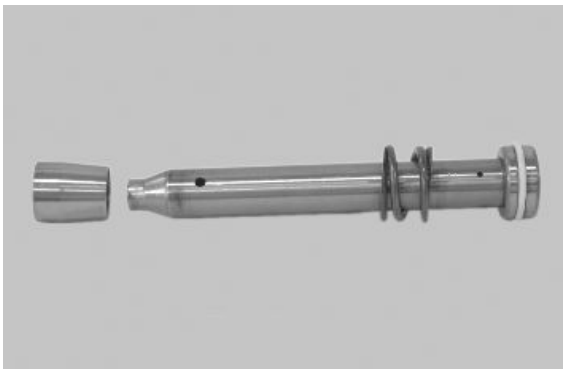
CAUTION

CLEAN ALL THE COMPONENTS THOROUGHLY.

- Check that the fork leg is not cracked or broken in the attachments.
- Check that the stem is not scored, dented or distorted.
- Check that the stop bushing for the hydraulic rod is correctly fixed through caulking.



- Check that hydraulic rod caulkings, the return spring to the unloaded the end of stroke and the hydraulic rod sealing ring are in good conditions.



- Check that the main spring exhibits no signs of yielding or abnormal wear.

- Check that the closing cap O-ring of the stem is in good conditions.

Refitting

- First grease the splitting chamber of the two sealing lips of a new oil seal.
- Fit the sealing ring on the stem and keep the identification words facing upwards.
- Drive the oil seal as far as it will go using the appropriate tool.

Specific tooling

020376Y Adapter handle

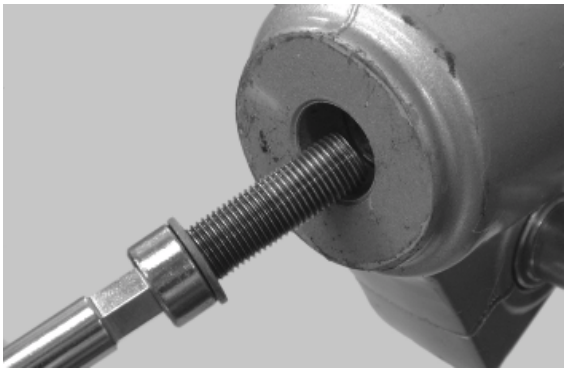
020359Y 42 x 47-mm adaptor

- Pre-fit the stem with the hydraulic rod, the spring and the stop bushing.
- Fit the pre-assembled components inside the fork leg.

- Fit the hydraulic rod fixing screw with the copper sealing washer and tighten to the prescribed torque using the recommended product.

CAUTION

ALWAYS USE NEW COPPER WASHER.

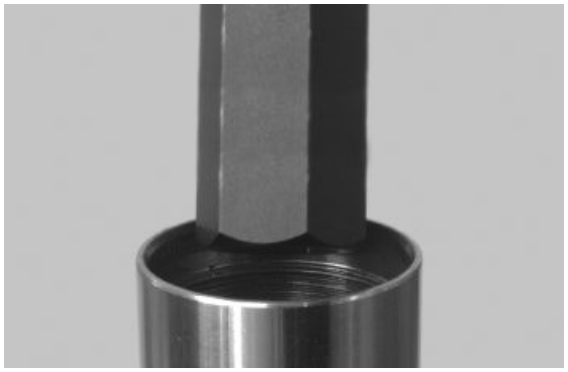


Locking torques (N*m)

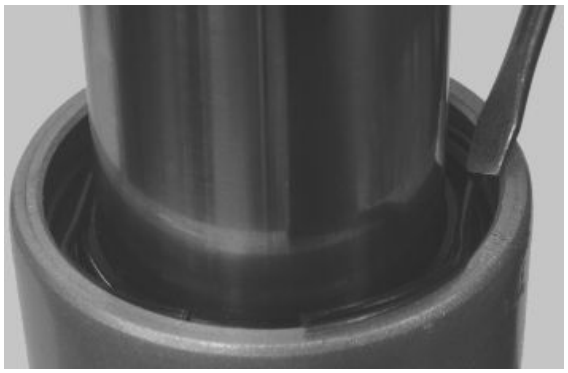
Hydraulic rod fixing screw 25 ÷ 35*

(°) Apply LOCTITE 243 threadlock

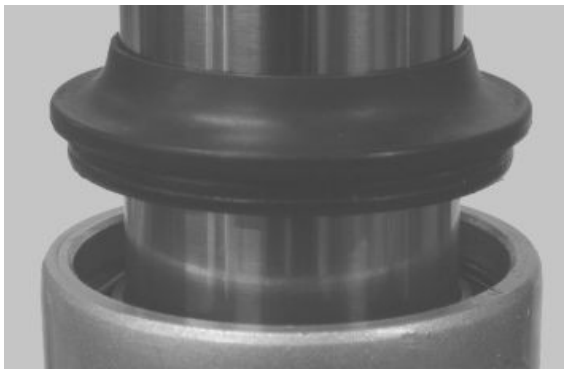
- Lock hydraulic rod rotation using a 19-mm hexagonal spanner.



- Fit the oil seal retaining circlip.



- Grease and fit a new dust guard.

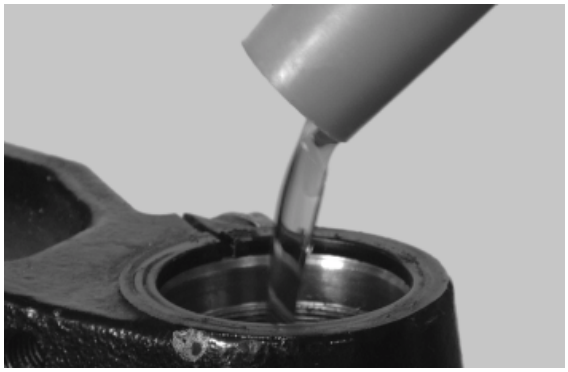


- Fit the fork leg together with the stem on the fork supporting clamp until it stops.
- Tighten the two screws to the prescribed torque in the sequence indicated in the picture.

Locking torques (N*m)

Stem support clamp tightening screws **20 to 25**

- Refill the fork leg with the recommended product to the prescribed amount.



Recommended products

AGIP FORK 7.5 W Oil for fork.

-

Characteristic

Oil quantity per stem

133 ± 3 cm³

- Bleed the hydraulic rod by actuating the stem repeatedly.
- Fit the spring into the stem.

CAUTION

FIT THE SPRING WITH THE SMALLER PITCH TO THE UPPER PART OF THE STEM.

- Lubricate the closing cap O-ring of the stem.
- Preload the spring, fit the closing cap and tighten to the prescribed torque.

Locking torques (N*m)

Fork locking screws cap **15 ÷ 30**

- Repeat the procedure for the other fork leg.

NOTE

IF BOTH FORK LEGS ARE SERVICED AT THE SAME TIME, BE CAREFUL NOT TO INVERT THE RIGHT FORK LEG WITH THE LEFT ONE.

Steering column

Refitting

- Fit the lower steering bearing on the steering tube.
- Fit the fork together with the lower steering bearing on the headstock and hold it so that it does not fall.

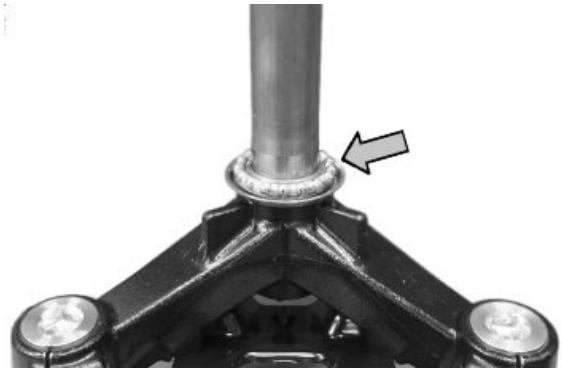
NOTE

LUBRICATE THE STEERING FIFTH WHEEL TRACKS WITH RECOMMENDED GREASE BEFORE USE.

Recommended products

AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

TL 9150 066, symbol NATO G 460



- Fit the upper steering bearing.

CAUTION

INSERT THE UPPER STEERING BEARING WITH THE CAGE FACING UPWARDS.

- Fit the steering bearing upper seat.

- Fit the cover plate.

- Insert the spacer.

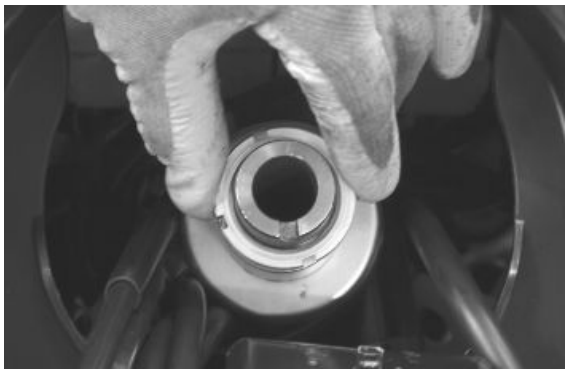
- Insert the lower tightening ring nut, screw until it stops and, with the specific tool, tighten to the prescribed torque.

Specific tooling

020055Y Wrench for steering tube ring nut

Locking torques (N*m)

Steering tube lower ring nut 14 ÷ 17



- Fit the spacer between the two ring nuts on the steering tube in the position indicated.

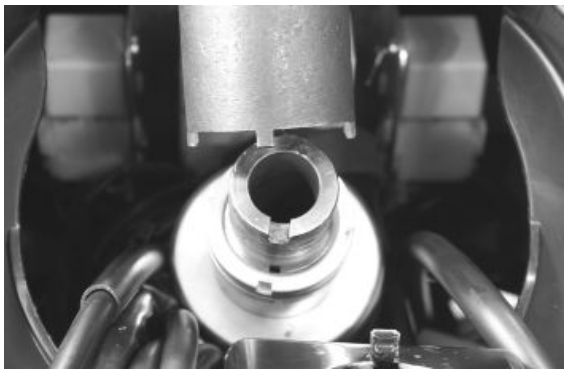
- Insert the upper tightening ring nut, screw until it stops and, with the specific tool, tighten to the indicated torque.

Specific tooling

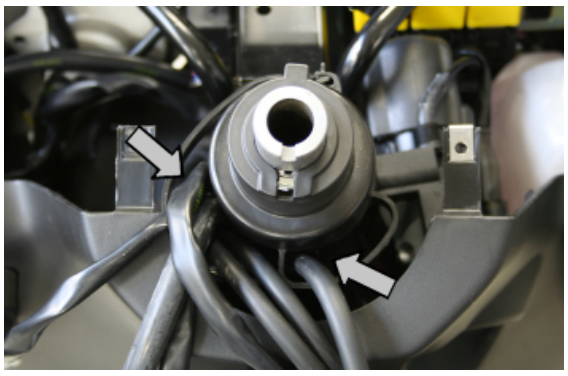
020055Y Wrench for steering tube ring nut

Locking torques (N*m)

Steering tube upper ring nut **40 ÷ 45**



Insert the collar shown in the figure and restore the cable passage as shown in the figure.



- Fit the front wheel.

Steering bearing

Removal

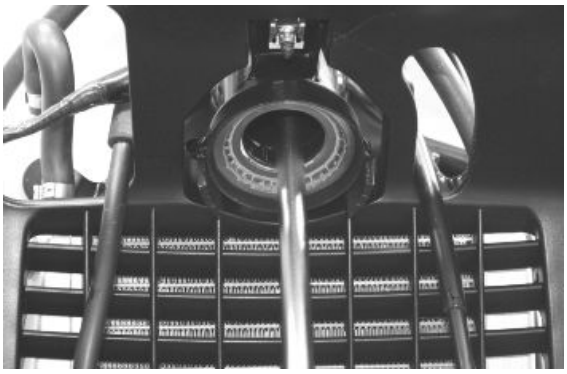
- Clean thoroughly and visually inspect if the components are in good conditions.
- Check the upper steering bearing for wear.

- Check the lower steering bearing for wear.

- Visually inspect that the steering fifth wheel tracks, the headstock and the steering tube exhibit no scores or abnormal wear. Otherwise, replace them.

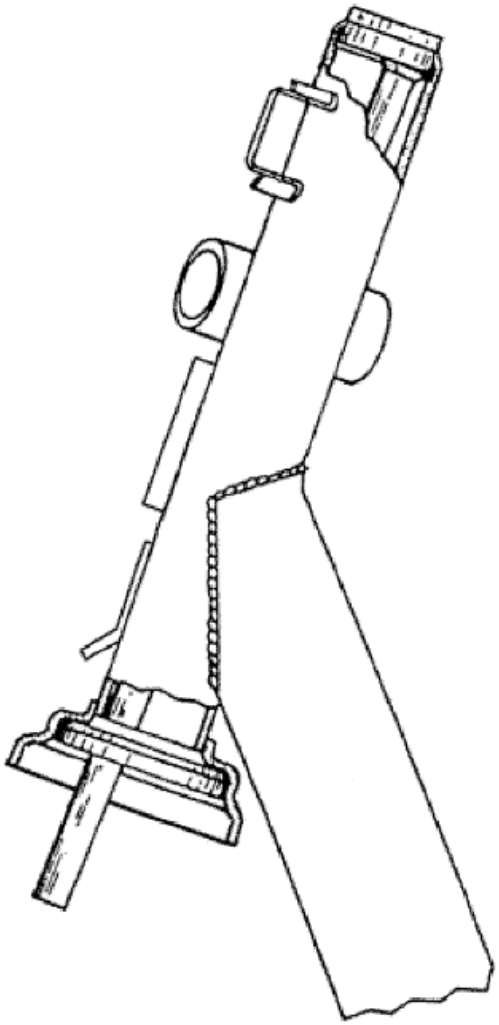
STEERING FIFTH WHEEL TRACK REMOVAL

- Remove the steering fifth wheel tracks on the chassis with the specific tool, following the indicated procedure.
- Fit the specific tool from the lower part of the headstock until it makes contact with the upper track.
- Hit with force the specific tool, placing it at different points diametrically opposed so as to remove the upper track.



Specific tooling

020004Y Punch for removing steering bearings from headstock



- Repeat the procedure for the lower steering bearing track.

- Remove the lower steering bearing seat on the steering tube using the specific tool.

Specific tooling

020004Y Punch for removing steering bearings from headstock

Refitting

STEERING FIFTH WHEEL TRACK FITTING

- Thoroughly clean the track seats on the headstock and the steering tube.
- Fit the new tracks of the headstock with the specific tool.
- Screw the nut until the tracks are fully inserted.

NOTE

LUBRICATE THE STEERING FIFTH WHEEL TRACKS WITH RECOMMENDED GREASE BEFORE USE.

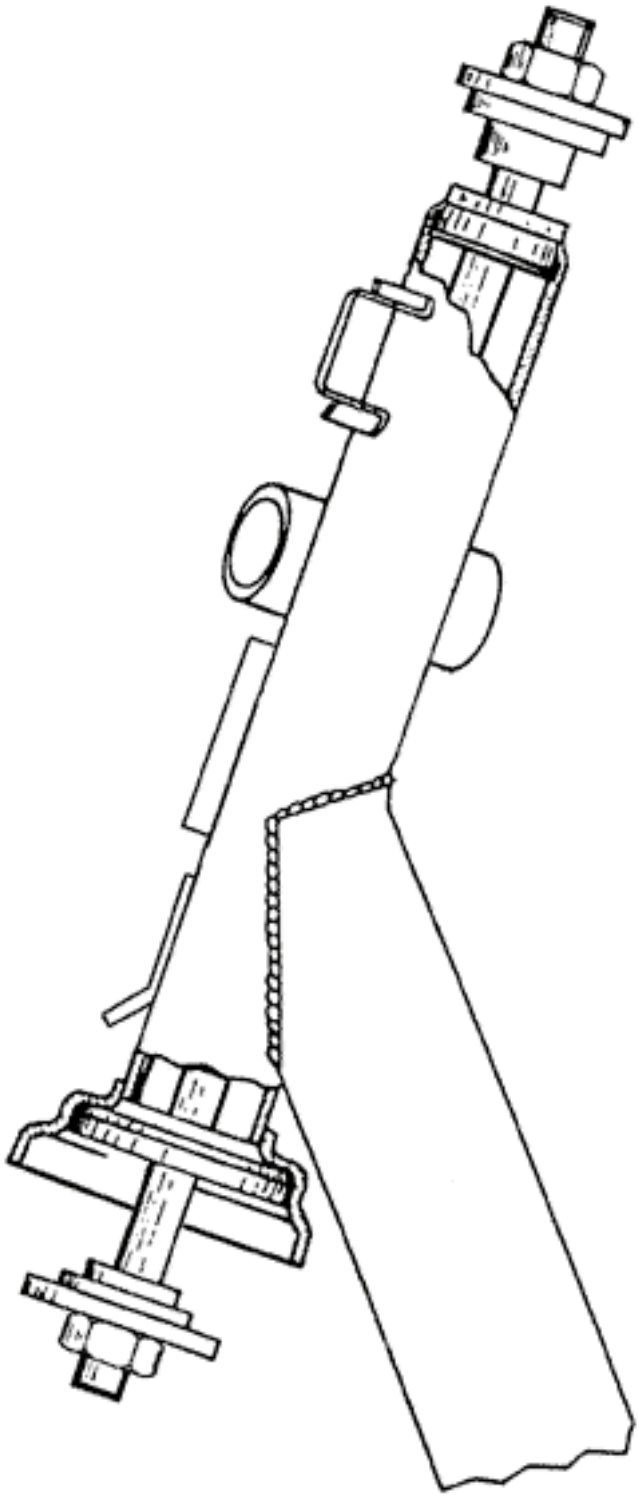
Specific tooling

001330Y Tool for fitting steering seats

Recommended products

AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

TL 9150 066, symbol NATO G 460



- Fit the lower fifth wheel seat on the steering tube.

- Using the specific tool, fit the lower fifth wheel seat on the steering tube.

NOTE

LUBRICATE THE STEERING FIFTH WHEEL TRACKS WITH RECOMMENDED GREASE BEFORE USE.

Specific tooling

020459Y Punch for fitting bearing on steering tube

Recommended products

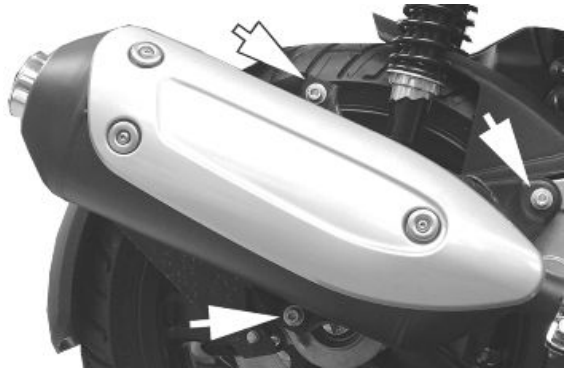
AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

TL 9150 066, symbol NATO G 460

Rear

Removing the rear wheel

Remove the full muffler assembly.



- Remove the cotter pin, the cap, the wheel axle fixing nut and the outer one of the two spacers.

- Remove the two screws fixing the mudguard to the bracket

- Remove the two screws fixing the bracket to the engine

- Slide off the wheel axle bracket, using the heat gun if necessary.

- Remove the 5 bolts of the wheel and remove

Refitting the rear wheel

To fit, follow the removal steps but in the reverse sequence, being careful to fit the spacers on the wheel axle as shown in the picture.

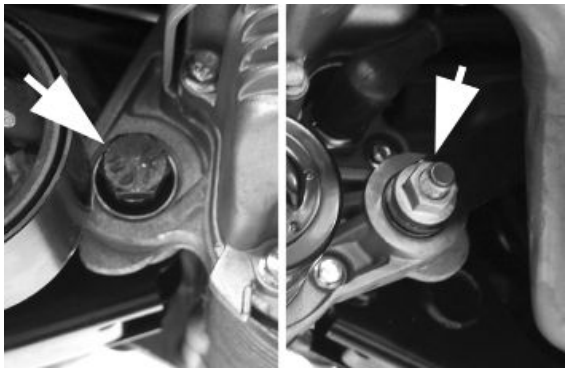
Locking torques (N*m)

Silencer arm clamping screws 27 - 30 **Rear wheel axle nut** 104 to 126 **Shock absorber-crank-case attachment bracket** 20 to 25 **Lower shock absorber clamping screw** 33 - 41 Nm **Rear brake calliper fixing screws** 25 - 30 Nm

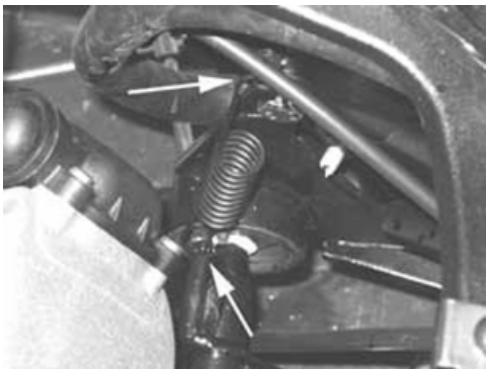
Swing-arm

Removal

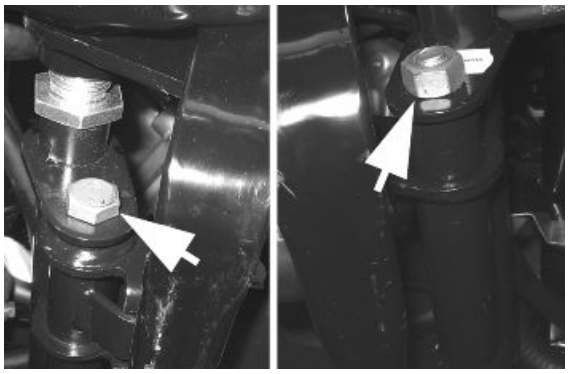
- Place the vehicle on its centre stand;
- Remove the swinging arm/engine fitting shown in the picture
- Move the engine back



- Remove the spring anchoring the swinging arm to the chassis as shown in the picture



- Remove the two screws fixing the buffer support bracket to the chassis



- Undo the nut on the LHS shown in the figure and remove the corresponding bolt from the opposite side.
- Remove the swinging arm.

- Check the entire swinging arm assembly.
- Check all the centring bushing components and silent block rubber buffers.
- Replace the work components that cause excessive clearance on the rear suspension.

Overhaul

- Check there is no sticking in the movement of the connection of the swinging arm on the engine side to the swinging arm on the chassis side.
- Check the axial clearance between the two swinging arms using a feeler gauge

Characteristic

Standard clearance

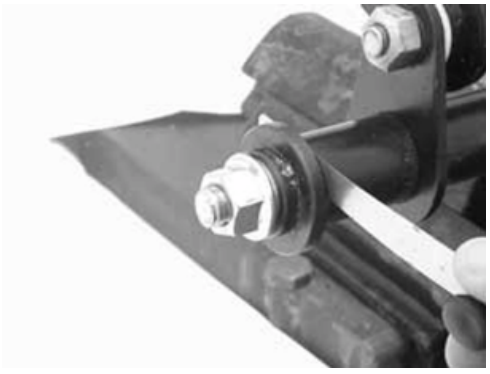
0.40 - 0.60 mm

Allowable limit after use:

1.5 mm

- In order to check the clearance of the swinging arm on the frame side, prepare a retainer using the fixing pin of the swinging arm on the frame and two rings from the special tool 020229Y. Alternatively, use two washers with 12-mm inside diameter for pins, minimum 30-mm outside diameter and 4-mm thick at least.

- Check there is no sticking in the rotation.
- Check the axial clearance of the swinging arm on the chassis side



Characteristic

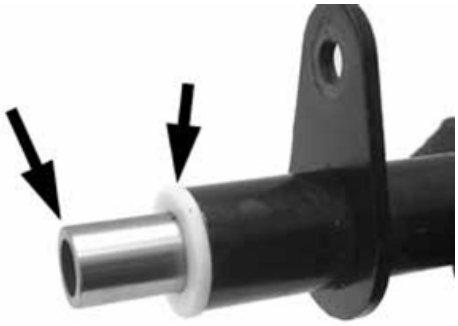
Standard clearance

0.40 - 0.60 mm

Allowable limit after use:

1.5 mm

- Separate the swinging arm on the engine side from the vehicle side arm.
- Remove the plastic bushings and the internal spacer shown in the picture.



- Using a suitable pin remove the roller casings as shown in the pictures

- Using an appropriate tool plant new roller casings, being careful to position the bearings with the seal rings facing outwards

Specific tooling

020244Y 15-mm diameter punch

020115Y Ø 18 punch

Characteristic

Length of the swinging arm tube on the engine side:

L 175.3 + 0.3 0

Length of the internal swinging arm spacer on the engine side:

L 183 + 0.3 0

Engine side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Chassis side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Length of the internal swinging arm spacer on the frame side:

290 ± 0.1 mm

Length of the swinging arm tube on the chassis side:

283 ± 0.1 mm

- Lubricate roller casings and the plastic bushings with grease
- Insert the spacers
- Assemble the two arms with the relative bolt in the position shown in the picture
- Adjust the bolt as shown in the picture
- Position the chassis side swinging arm with the most protruding part pointing towards the silent block side as shown in the picture

Recommended products

AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

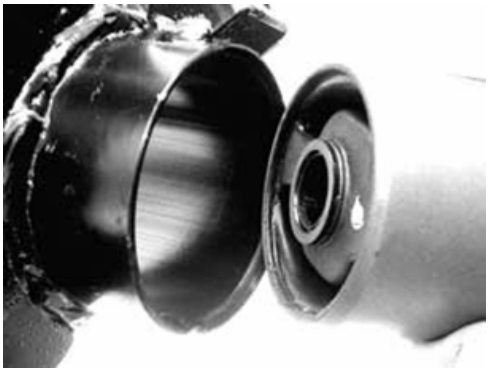
TL 9150 066, symbol NATO G 460

- Make sure the silent bloc is not broken. If it is, replace the coupling.
- Remove the Seeger ring shown in the picture

- Remove the full silent bloc bracket
- Undo the silent bloc ring shown in the picture

- Hold the full silent bloc bracket in the clamp
- Using the appropriate tool, remove the silent bloc from the bracket from the side corresponding to the inside of the vehicle. This is to guarantee the tool is centred properly on the support

- Install a new silent bloc, making sure it aligns properly with the reference tooth.
- Fit the silent blocs, making sure the chamfered part of the silent bloc matches the chamfered part of the bracket



- Using the appropriate tool, fit the silent bloc as shown in the picture

Refitting

- To refit, perform the removal operations in reverse.
- Grease the bearings and the rolling parts with the recommended grease.

-Complete the fitting by tightening the nuts on the relative bolts to the proper tightening torque.

Locking torques (N*m)

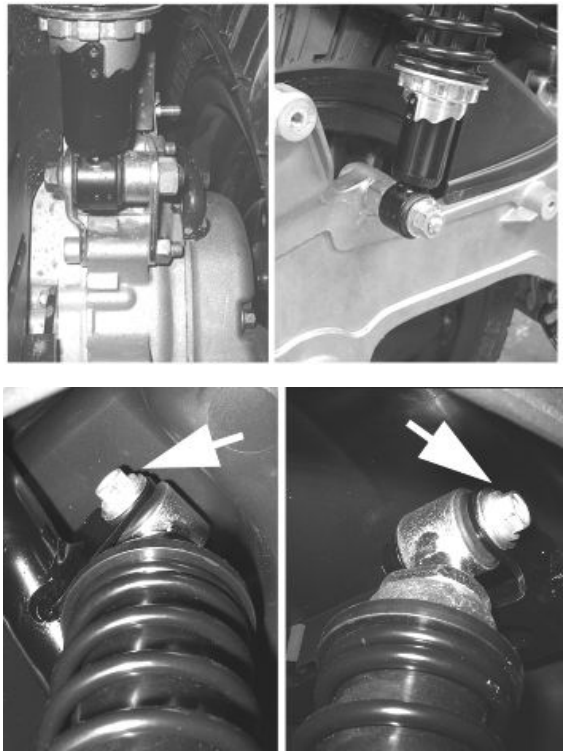
Engine and vehicle side swinging arm junction bolt 33 ÷ 41 Nm Swinging arm pin - Engine 64 ÷ 72 Body shell - Swinging arm pin 76 ÷ 83 Screw fixing the silent-block support plate to the body 42 ÷ 52

Shock absorbers

Removal

Proceed as follows:

- place the vehicle on its centre stand;
- lift the engine a little with a jack so as to free the two shock absorbers;
- remove the silencer
- undo the shock absorber spring assembly clamping screw from the support fixed to the engine on the one side and from that fixed to the silencer on the other;
- unscrew the two upper nuts (one on each side) fixing the shock absorber spring assembly to the frame and remove the shock absorbers.



Refitting

Carry out the previous operations but in reverse order.

Locking torques (N*m)

Shock absorber lower clamping 33 to 41 Shock absorber upper clamp 33 to 41

Centre-stand

REMOVAL

- Use a jack to support the vehicle properly.
- Remove the two return springs from the centre stand.
- Undo the nut shown in the figure.
- Remove the pin from the right side.
- Remove the centre stand.

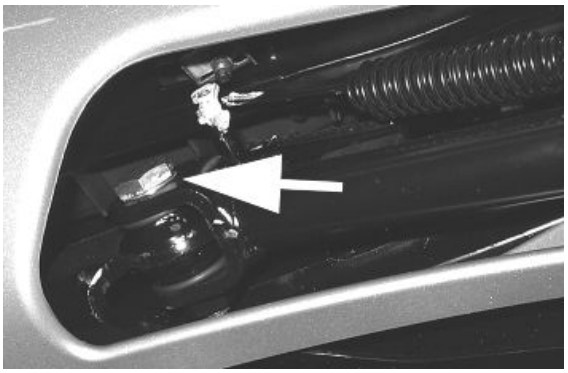
FITTING

- On refitting tighten the nut to the specified torque.

Locking torques (N*m)

Centre stand bolt **32 to 40**

Side stand



REMOVAL

- Uncouple the centre stand return spring;

Remove the screw shown in the photograph

FITTING

To refit, carry out the removal operations in reverse order and comply with the specified torque.

Locking torques (N*m)

Side stand fixing bolt **35 to 40**

INDEX OF TOPICS

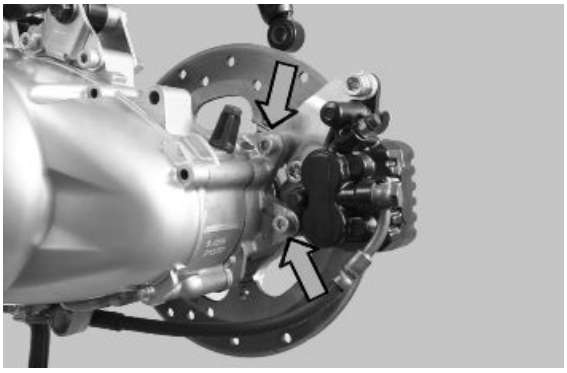
BRAKING SYSTEM	BRAK SYS

This section è is dedicated to the description of the brake system components.

Rear brake calliper

Removal

- Remove the rear wheel.
- Remove the two rear brake calliper devices fastening them to the support as shown in the picture.

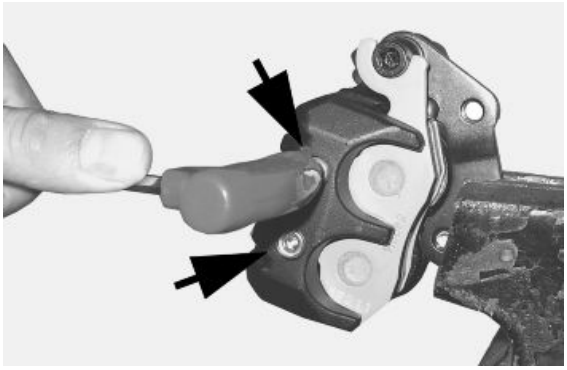


NOTE

IF IT IS NECESSARY TO REPLACE OR SERVICE THE BRAKE CALLIPER, BEFORE REMOVING THE FITTINGS FIXING THE CALLIPER TO THE SUPPORT BRACKET, FIRST LOOSEN THE OIL HOSE FITTING AFTER HAVING EMPTIED THE SYSTEM OF THE CIRCUIT BEING EXAMINED.

Overhaul

- Remove the brake calliper.
- Suitably support the brake calliper in a vice
- Remove the two pad fixing screws.
- Remove the pads being careful with the stop spring.



- Remove the fixed plate by undoing the screw shown in the photograph.

- Remove the internal parts from the floating body with short blasts of compressed air through the brake liquid pipe to facilitate expelling the plungers.
- Check:
  - that the plates and the body are whole and in good condition;
  - that the cylinders of the calliper floating body do not show signs of scratches or erosion, otherwise replace the entire calliper:
  - that the guides of the fixed plate are not scratched or eroded, otherwise replace the entire plate;
  - that the brake pad check spring works properly

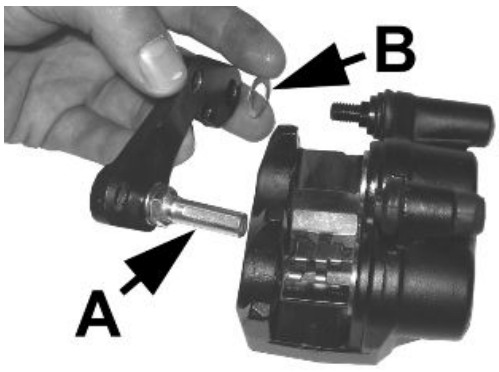
CAUTION

ALL THE SEALS AND GASKETS MUST BE REPLACED EVERY TIME THE PUMP IS SERVICED.

Refitting

- Insert the O-rings and small pistons the floating body, lubricating all the components with brake fluid.

- Fit the fixed plate being careful to grease guide A and to insert washer B as indicated in the photo.



- Fit the pad retention spring
- Fit the pads and screw up the relative clamping screws to the specified torque

- Hold the pads in the correct position and insert the calliper in the brake disc.
- Fix the support calliper by means of the two screws at the specified torque
- Secure the pipe fitting to the calliper at the specified torque.
- Bleed the air from the system.

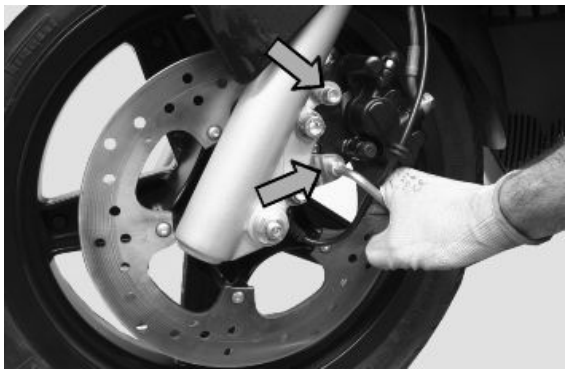
Locking torques (N*m)

Rear brake calliper fixing screws 20 to 25 Engine- calliper support plate fixing screws 48 ÷ 52

Front brake calliper

Removal

- Remove the two front brake calliper devices fastening them to the support as shown in the photograph.

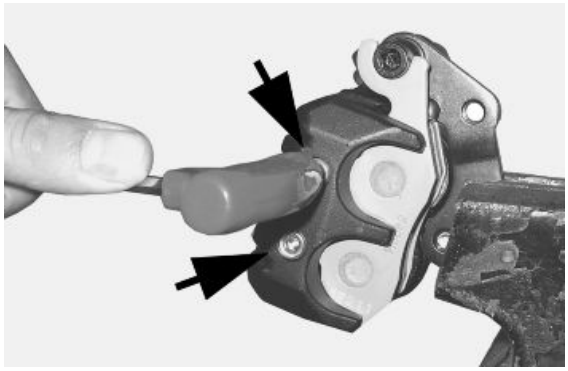


NOTE

WHEN A PROCEDURE IS PLANNED INCLUDING THE SERVICE OR REPLACEMENT OF THE CALLIPER, FIRST LOOSEN THE FITTING CONNECTING THE PIPE TO THE BRAKE CALLIPER

Overhaul

- Remove the brake calliper.
- Suitably support the brake calliper in a vice
- Remove the two pad fixing screws.
- Remove the pads being careful with the stop spring.



- Remove the fixed plate by undoing the screw shown in the photograph.

- Remove the internal parts from the floating body with short blasts of compressed air through the brake liquid pipe to facilitate expelling the plungers.
- Check:
  - that the plates and the body are whole and in good condition;
  - that the cylinders of the calliper floating body do not show signs of scratches or erosion, otherwise replace the entire calliper:
  - that the guides of the fixed plate are not scratched or eroded, otherwise replace the entire plate;
  - that the brake pad check spring works properly

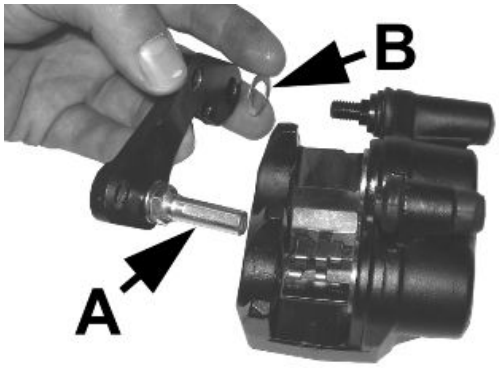
CAUTION

ALL THE SEALS AND GASKETS MUST BE REPLACED EVERY TIME THE PUMP IS SERVICED.

Refitting

- Insert the O-rings and small pistons the floating body, lubricating all the components with brake fluid.

- Fit the fixed plate being careful to grease guide A and to insert washer B as indicated in the photo.



- Fit the pad retention spring
- Fit the pads and screw up the relative clamping screws to the specified torque

- Hold the pads in the correct position and insert the calliper in the brake disc.
- Fix the support calliper by means of the two screws at the specified torque
- Secure the pipe fitting to the calliper at the specified torque.
- Bleed the air from the system.

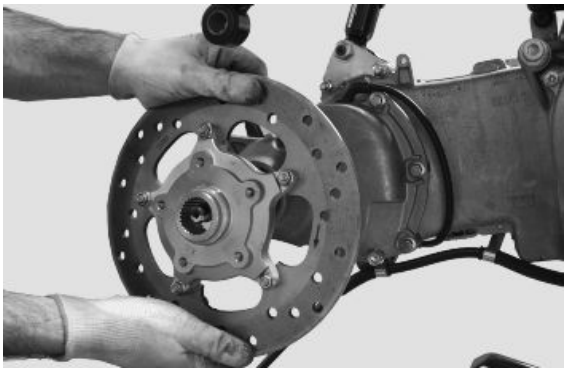
Locking torques (N*m)

Screw tightening calliper to support 24 to 27 Pad fastening pin 19.6 ÷ 24.5 Calliper support plate - fork fixing screws 41 ÷ 51

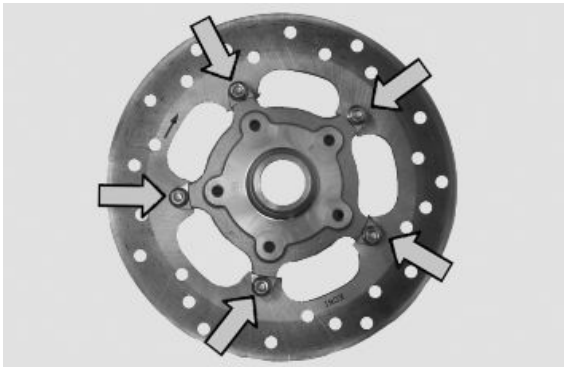
Rear brake disc

Removal

- Remove the rear wheel.
- Remove the brake calliper.
- Remove the disc from the wheel axle.



- Undo the five screws and remove the disc from the wheel hub.



Refitting

For fitting, position the disc correctly using the arrow stamped on it as reference.

- Do up the screws to the prescribed torque and apply the recommended product

NOTE

THE ARROW STAMPED ON THE DISC INDICATING THE RUNNING DIRECTION MUST BE FITTED TOWARDS THE OUTSIDE OF THE VEHICLE.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Brake disc screws 8 to 10

Disc Inspection

- Remove the rear brake calliper.
- Check the disc thickness with a micrometer

Characteristic

Standard thickness:

5 +0.2-0.1 mm

Disc thickness at wear limit

4.5 mm

- Repeat the measurement at no fewer than six points on the disc.
- Check the regular nature of the rotation of the brake disc assembly using the appropriate tool fixed onto the brake calliper as shown in the photo.
- In order to be able to anchor the appropriate tool properly use a metal plate with M8 threaded hole and fix it to one of the two rear brake calliper attachment points.
- Suitably fix the flange to the wheel axle with the original nut and spacer and a Æ 17 mm bearing.

NOTE

SO AS NOT TO GET A DISTORTED READING, CAUSE THE DRIVEN PULLEY SHAFT TO TURN IN ORDER TO ROTATE THE DISC.

Specific tooling

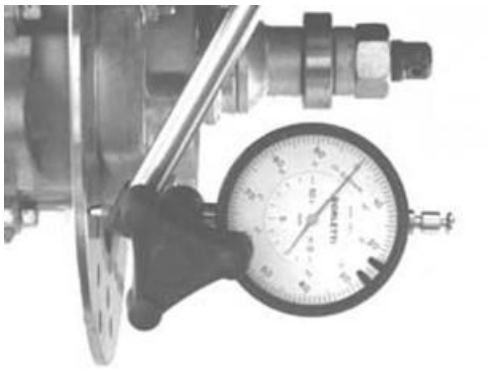
020335Y Magnetic mounting for dial gauge

Characteristic

Max. deviation allowed:

0.1 mm

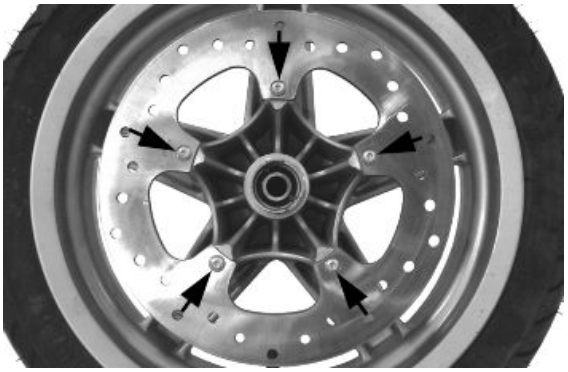
- If you detect incorrect values, replace the disc. If the anomaly persists, replace the hub.



Front brake disc

Removal

- Remove the front wheel.
- Undo the five clamping screws shown in the photograph



Refitting

For fitting, position the disc correctly using the arrow stamped on it as reference.

- Do up the screws to the prescribed torque and apply the recommended product

NOTE

THE ARROW STAMPED ON THE DISC INDICATING THE RUNNING DIRECTION MUST BE FITTED TOWARDS THE OUTSIDE OF THE VEHICLE.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Brake disc screws 8 to 10

Disc Inspection

Checking the disc is important; it must be perfectly clean, with no sign of rust, oil or grease or any other dirt, and must show no signs of deep scoring.

Characteristic

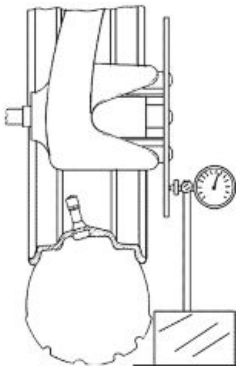
Standard thickness:

5 +0.2-0.1 mm

Disc thickness at wear limit

4.5 mm

- Using the appropriate tool, measure how much the disc protrudes when the wheel is fitted properly. The protrusion, measured near the external edge of the disc, must be less than 0.1 mm.
- If a value is measured other than the specified value, remove the front wheel (Front/Rear Suspension chapter) and check the protrusion of the disc. Maximum permissible out of true is 0.1 mm. If the value measured is greater, replace the disc and repeat the check.
- If the problem persists, check and replace the wheel hub if necessary.



Specific tooling

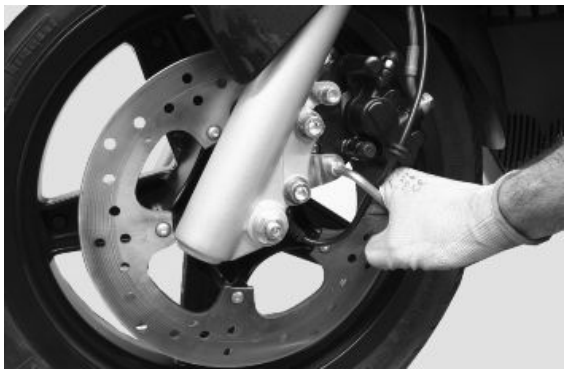
020335Y Magnetic mounting for dial gauge

Front brake pads

Removal

Proceed as follows:

- Remove the front brake calliper.

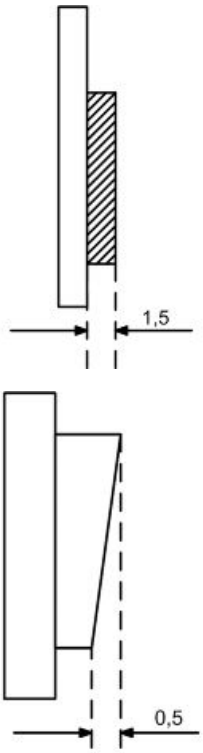


- Loosen the two pins shown in the figure that lock the two pads.
- Remove the pads, being careful with the pad spring clamp.
- Check the thickness of the pads.

Characteristic

Minimum value

1.5 mm



See also

Refitting

To fit, proceed as follows:

- Insert the two pads in the callipers.
- Screw the two pad lock pins to the correct torque, and apply the recommended product.
- Fit the calliper on its support, tightening the two screws to the prescribed torque.

NOTE

IF IT IS NOT POSSIBLE TO CORRECTLY POSITION THE CALLIPER ON THE DISC DURING FITTING, GENTLY EXPAND THE PADS.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

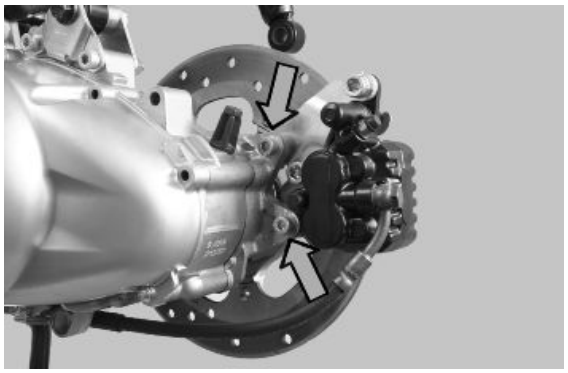
Screw tightening calliper to support 24 to 27 Pad fastening pin 19.6 ÷ 24.5

Rear brake pads

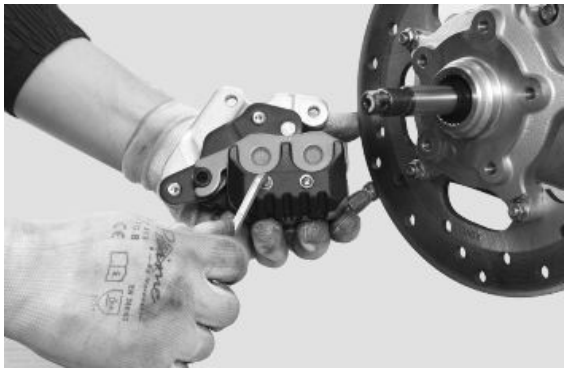
Removal

Proceed as follows:

- Remove the rear brake calliper.



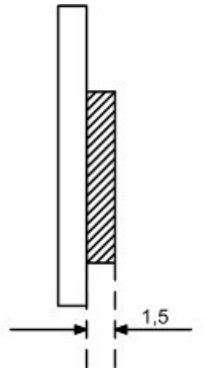
- Loosen the two pins shown in the figure that lock the two pads.
- Remove the pads, being careful with the pad spring clamp.
- Check the thickness of the pads.

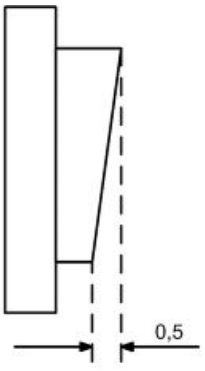


Characteristic

Minimum value

1.5 mm





See also

Refitting

To fit, proceed as follows:

- Insert the two pads in the callipers.
- Screw the two pad lock pins to the correct torque, and apply the recommended product.
- Fit the calliper on its support, tightening the two screws to the prescribed torque.

NOTE

IF IT IS NOT POSSIBLE TO CORRECTLY POSITION THE CALLIPER ON THE DISC DURING FITTING, GENTLY EXPAND THE PADS.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Screw tightening calliper to support 24 to 27 Pad fastening pin 19.6 ÷ 24.5

Fill - Bleeding the braking system

Rear - combined

- Remove the rubber cap from the bleed screw.
- Insert a rubber pipe in the bleed screw to permit the brake fluid to be recovered.
- With the left-had brake lever, load the system and bring it up to the required pressure.
- Keeping the left-hand brake lever pulled, loosen the bleed screw to permit the air in the system to escape. Then tighten the bleed screw

- Repeat the operation until only brake fluid comes out of the rubber pipe.
- Remove the fluid recovery pipe and refit the rubber cap over the bleed screw.
- Top up the brake fluid to the right level in the reservoir.

If necessary, bleeding can be done using a special vacuum pump

NOTE

DURING THE BLEEDING OPERATIONS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE BODYWORK SO AS NOT TO DAMAGE IT. FURTHERMORE, DURING THE BLEEDING OPERATIONS REGARDING THE BRAKE CALLIPERS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE DISC BRAKES AND WITH THE BRAKE PADS. FAILURE TO OBSERVE THIS PRECAUTION WILL ENDANGER THE PROPER WORKING AND EFFICIENCY OF THE BRAKING SYSTEM

Specific tooling

020329Y Vacuum pump Mity-Vac

Locking torques (N*m)

System bleed calliper fitting: 12 ÷ 16 Nm

Front

- Remove the rubber cap from the bleed screw.
- Insert a rubber pipe in the bleed screw to permit the brake fluid to be recovered.
- With the right-hand brake lever, load the system and bring it up to the required pressure.
- Keeping the right-hand brake lever pulled, loosen the bleed screw to purge the air. Then tighten the bleed screw
- Repeat the operation until only brake fluid comes out of the rubber pipe.
- Remove the fluid recovery pipe and refit the rubber cap over the bleed screw.
- Top up the brake fluid to the right level in the reservoir.

If necessary, bleeding can be done using a special vacuum pump

NOTE

DURING THE BLEEDING OPERATIONS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE BODYWORK SO AS NOT TO DAMAGE IT. FURTHERMORE, DURING THE BLEEDING OPERATIONS REGARDING THE BRAKE CALLIPERS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE DISC BRAKES AND WITH THE BRAKE PADS. FAILURE TO OBSERVE THIS PRECAUTION WILL ENDANGER THE PROPER WORKING AND EFFICIENCY OF THE BRAKING SYSTEM

Specific tooling

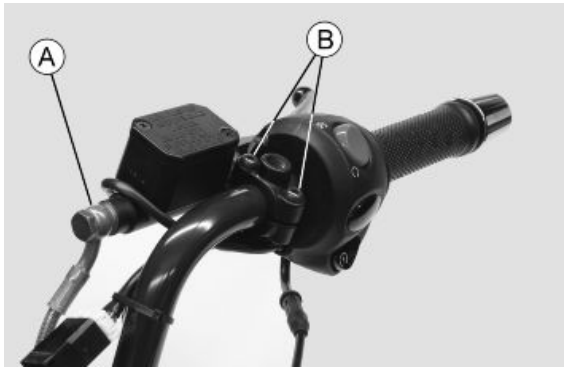
020329Y Vacuum pump Mity-Vac

Locking torques (N*m)

System bleed calliper fitting: 12 ÷ 16 Nm

Front brake pump

Removal



The procedure is valid for both brake pumps.

- Remove the front and rear handlebar covers.
- Place a suitable container to collect the oil, disconnect the oil pipe from the calliper and operate the brake lever until no more oil comes out.
- Disconnect the oil pipe «**A**» from the pump, then unscrew the two retainers «**B**» from the U-bolt and remove the pump.
- Upon refitting, tighten up the fitting to the specified torque and bleed the system.

CAUTION

ALWAYS USE NEW COPPER WASHERS.

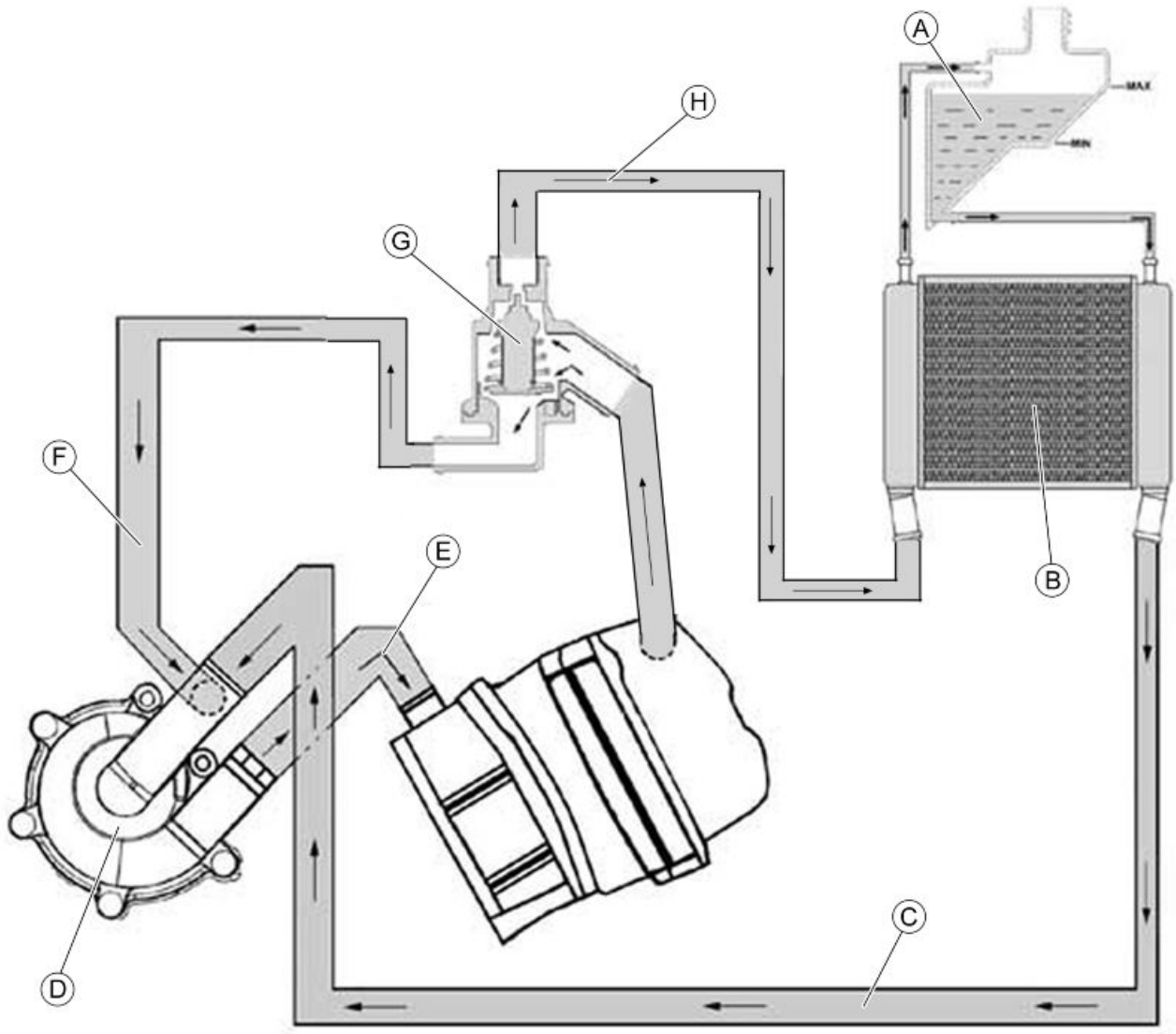
Locking torques (N*m)

Brake fluid pump-hose fitting 16 - 20 Fixing screws for the handlebar control unit U-bolts 7 to 10

INDEX OF TOPICS

COOLING SYSTEM	COOL SYS

Circuit diagram



KEY

A = Expansion tank

B = Radiator

C = Radiator intake pipe

D = Water pump

E = Delivery pipe to cylinder

F = By-Pass pipe

G = Thermostat

H = Radiator delivery pipe

Electric fan check

- Check and, if necessary, restore the correct battery voltage.

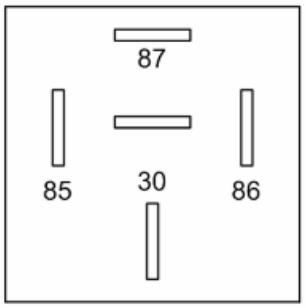
Characteristic

Battery voltage

12V

- Check that the electric ventilation relay is working properly.

- If the relay is not working, replace it.
- If the relay is operating, remove it and jump the red-green and red-black wires (85 - 86); all the components in proper operating conditions, the electric ventilation should be able to start.



- In order to check the coolant temperature sensor, see the «Injection» chapter.

See also

System bleed

- Start up the engine until the operating temperature is reached.
- Remove the rubber hood over the bleed valve
- Obtain a rubber tube that is of the right length to connect the valve to the expansion tank
- Place one end of the pipe on the bleed valve and the other in the expansion tank
- Loosen the screw by **two** turns until the communication hole is revealed with the head as shown in the picture
- Wait until only coolant comes out of the rubber pipe so as to eliminate any air bubbles inside the circuit.

- Tighten the bleed valve respecting the maximum torque.
- Bring the coolant up to the correct level inside the expansion tank

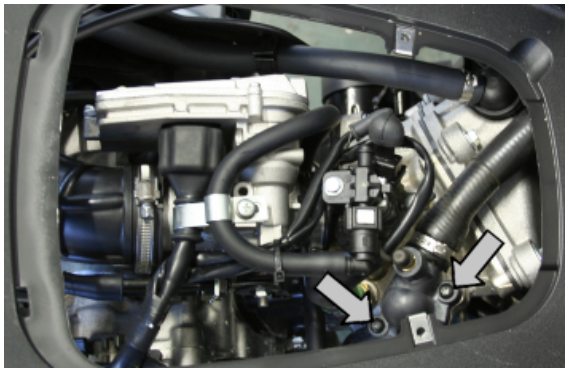
Locking torques (N*m)

Bleed screw 3

Thermostat

Removal

- Remove the helmet compartment inspection cover.
- Place a + 2.0 l container under the vehicle to collect the coolant.
- Undo the two screws indicated, lift the cover and remove the thermostat.



Check

1) Visually inspect that the thermostat is not damaged.

2) Fill a metal container with approx. 1 litre of water.

Immerse the thermostat, and keep it in the centre of the container.

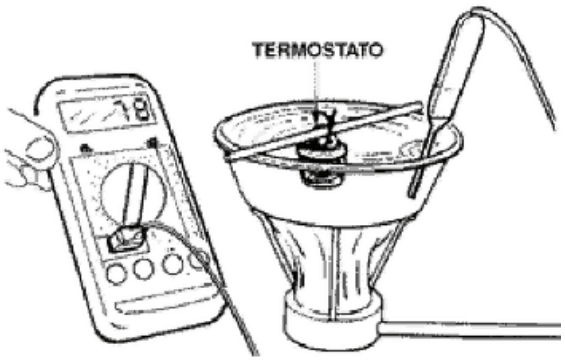
Immerse the multimeter temperature probe, and keep it close to the thermostat.

Heat up the container using the thermal gun.

Check the temperature at which the thermostat starts to open:

Heat up until the thermostat is completely open.

3) Replace the thermostat if it is not working properly.



CAUTION

TO EXECUTE THE TEST CORRECTLY, MAKE SURE NEITHER THE THERMOSTAT NOR THE THERMOMETER TOUCHES THE CONTAINER.

Specific tooling

020331Y Digital multimeter

020151Y Air heater

THERMOSTAT

Specification	Desc./Quantity
Type	Wax-type, with deviator
Starts opening at	85±2°C

Refitting

- Follow the removal steps but in reverse order; be careful to tighten screws to the prescribed torque.

Locking torques (N*m)

Thermostat cover screws 3 to 4

- Once the cooling circuit is restored, refill using the recommended product and purge the circuit as expressly indicated in the «Cooling System» chapter.

INDEX OF TOPICS

CHASSIS	CHAS

This section è is dedicated to the operations that can be carried out on the vehicle's bodywork.

Seat

- Remove the two clamping screws on the frame.
- Remove the control button of the undersaddle light.

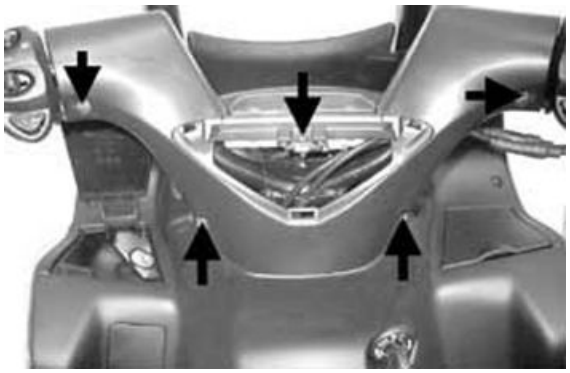
Rear handlebar cover

- Release the three retaining tabs of the rear handlebar cover shown in the figure using a screwdriver and paying attention not to damage the paintwork.

- Remove the five fixing screws from the rear handlebar cover.
- Remove the rear cover.

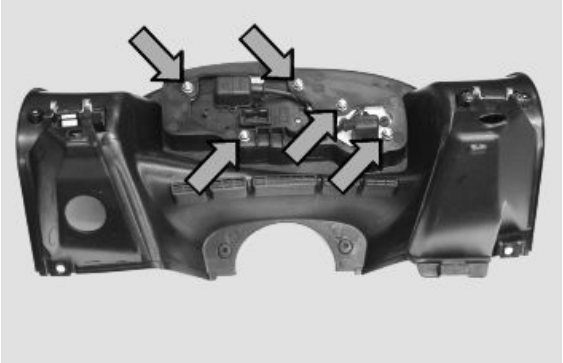
NOTE

WHEN INSTALLING, THE CENTRE SCREW IS A METAL SCREW, THE OTHER 4 ARE PLASTIC.



Instrument panel

- Remove the instrument panel.
- Loosen the five fixing nuts of the instrument panel.

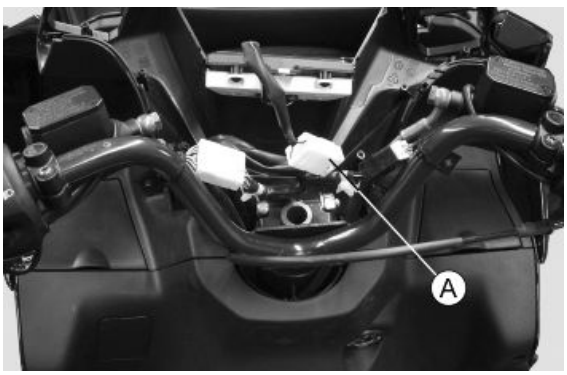


Front handlebar cover

- Remove the rear handlebar cover.
- Remove the left and right frames of the brake pump secured with two retaining fins.

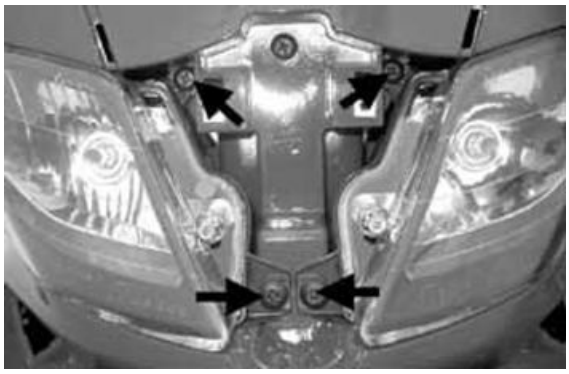
- Loosen the four fixing screws of the front handlebar cover with the handlebar itself.

- Disconnect the warning light unit connector «**A**».



Headlight assy.

- Remove the centre cover of the shield.
- Remove the 4 front retainers of the front light assemblies.



- To remove the right-hand light assembly, remove the screw located near the cover of the expansion tank.

- To remove the left-hand light assembly, remove the screw located in the left-hand storage compartment.

Remove the light, disconnecting the electric connector from the light and the complete lamp holder of the position light.

NOTE

THE TWO REAR ADJUSTMENT SCREWS SHOWN IN THE FIGURE ARE ADJUSTED DURING ASSEMBLY OF THE LIGHT AND MUST NOT BE ALTERED.

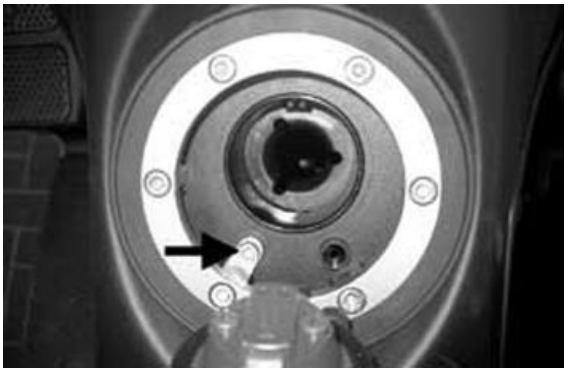
Frame central cover

The chassis central cover has a central tunnel and two side fairings, the procedure is the following:

CENTRAL TUNNEL:

- Remove the saddle together with the hinge.

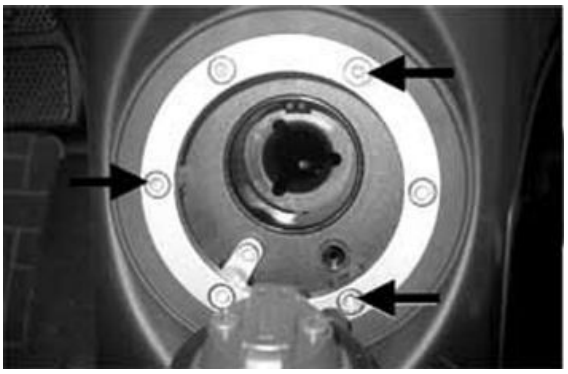
- Open the fuel tank flap.
- Undo the screw indicated in the figure.



- Undo the three screws indicated in the figure.

NOTE

THE OTHER 3 SCREWS HAVE ONLY AN AESTHETIC FUNCTION

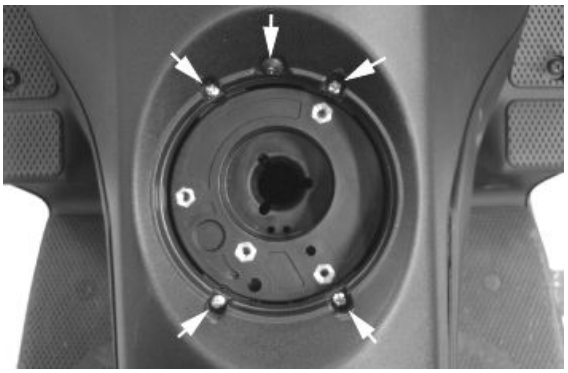


- Undo and remove from both vehicle sides the screw indicated in the figure.

- Undo the five screws indicated in the figure.

CAUTION

PROVISIONALLY PROTECT THE NECK OF THE FUEL TANK USING A CLEAN CLOTH TO PREVENT ANY DIRT OR OBJECTS ACCIDENTALLY FALLING INTO THE TANK.

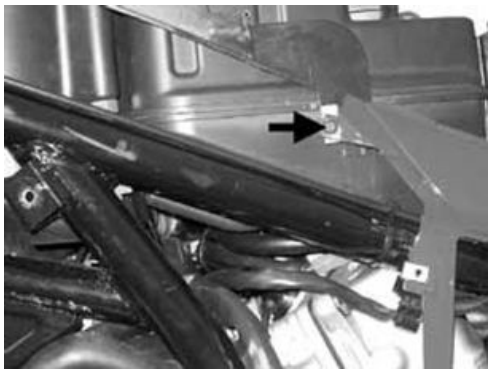


- Working from both sides, undo the screw indicated and release the retaining tongues to remove the side air deflectors.

- Undo from both sides the screw indicated in the figure.
- Remove the central tunnel sliding it from the tongues.

SIDE FAIRING:
- Remove the central tunnel.
- Remove the side fairings.
- Remove the handgrips and top side fairings.
- Remove the right and left footrests (see FOOTREST).

- Working from both sides, undo the screw indicated in the figure.
- Remove the side fairing sliding it from the tongues.



Legshield

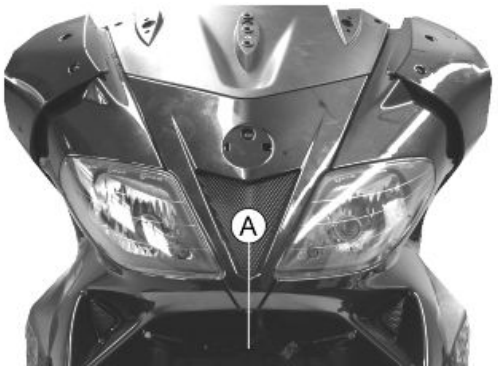
The front shield has a lot of sections. The removal procedure is described below:

FRONT LOWER FRAME:

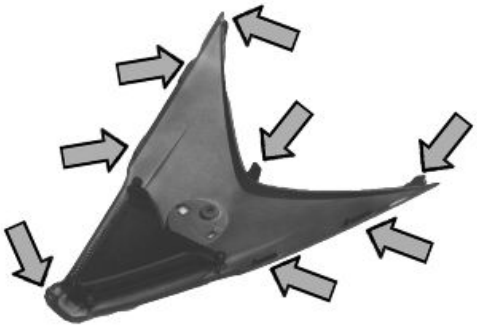
- Using a screwdriver, remove the clip-on badge.

- Undo and remove the screw under the badge.

- Undo and remove the screw «**A**».



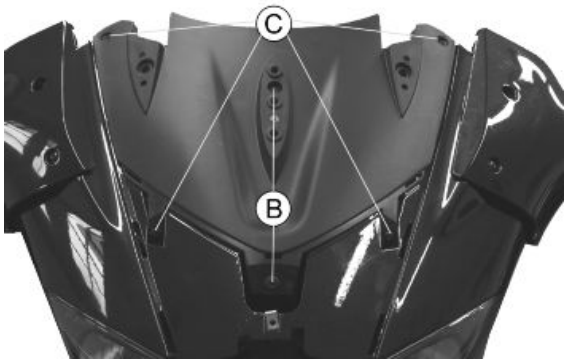
- Taking care not to damage the plastic tongues, remove the front lower frame sliding it upwards from bottom to top.



FRONT UPPER FRAME:

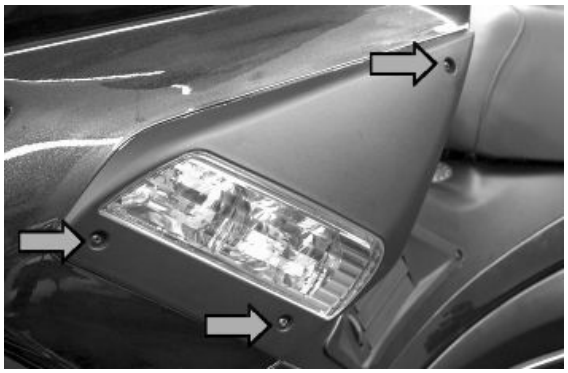
- Remove the FRONT LOWER FRAME.
- Remove the windshield together with the supports.

- Undo and remove the two screws «**B**» and the four screws «**C**».
- Remove the frame sliding it from the tongues.

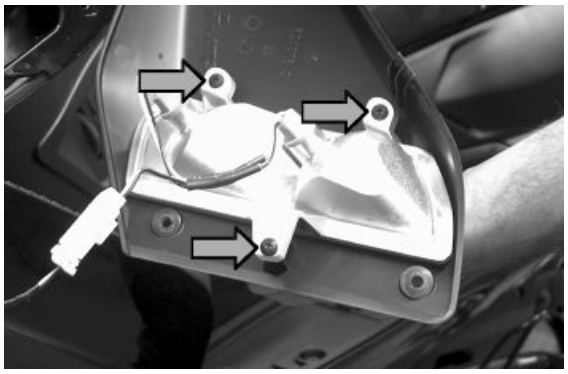


FRONT TURN INDICATORS:

- Undo and remove the three screws indicated.



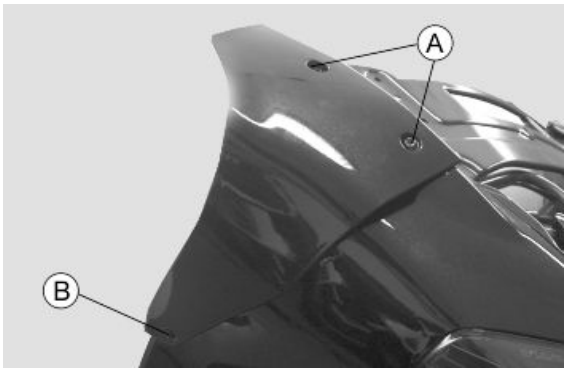
- Disconnect the front turn indicator connector.
- Undo and remove the three screws to remove the bulb holder from the support.



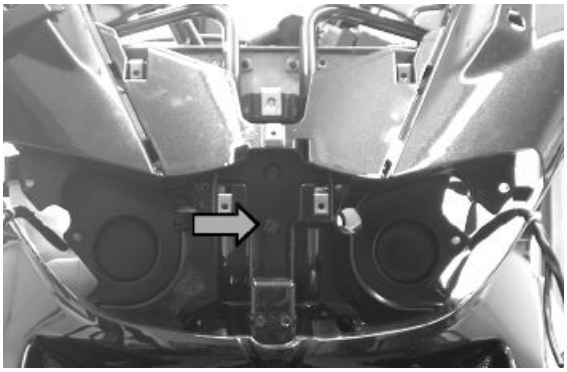
FRONT SHIELD:

- Remove the front lower frame.
- Remove the front upper frame.
- Remove the front headlight assemblies.
- Remove the instrument panel (see SHIELD BACK PLATE).
- Remove the lower shield back plate (see SHIELD BACK PLATE).

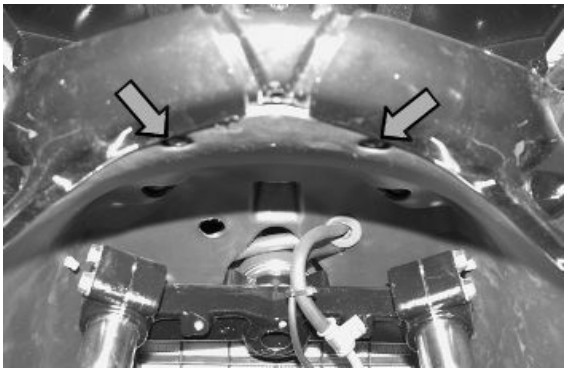
- Remove the hand guards unscrewing, from both sides, the two screws «**A**» collecting the washers and the screw «**B**».



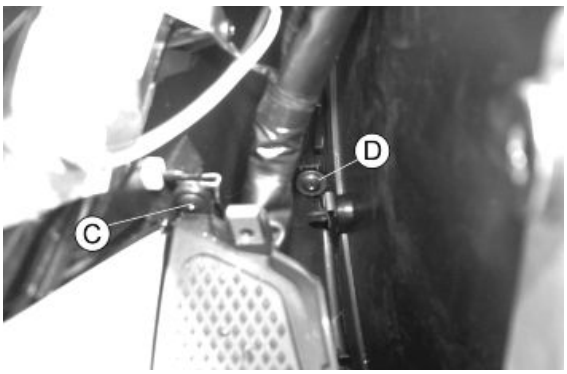
- Undo the central screw.



- Undo the two screws indicated.



- Undo the rider footrest fixing screw «**C**» and the spoiler fixing screw «**D**».
- Remove the front shield releasing the different cable harness from the clamps.



To refit follow the reverse order paying attention to fasten the cable harness with the relative clamps.

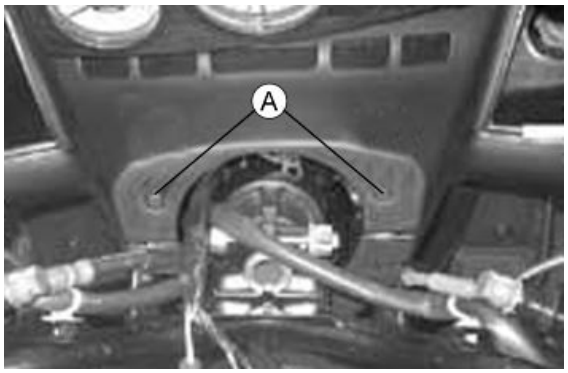
Knee-guard

The shield back plate is made by two sections. The instrument panel, with instrument unit and lower shield back plate. The procedure for both is described below:

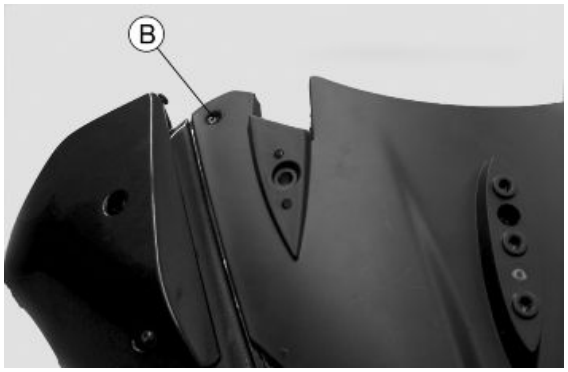
INSTRUMENT PANEL:

- Remove the windshield.
- Remove the rear handlebar cover.
- Remove the front handlebar cover.
- Remove the handlebar.

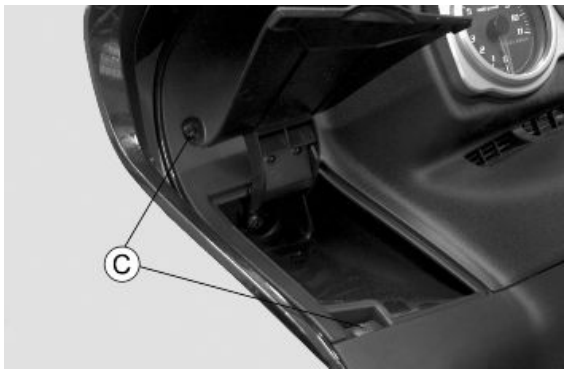
- Undo and remove the two screws «**A**».



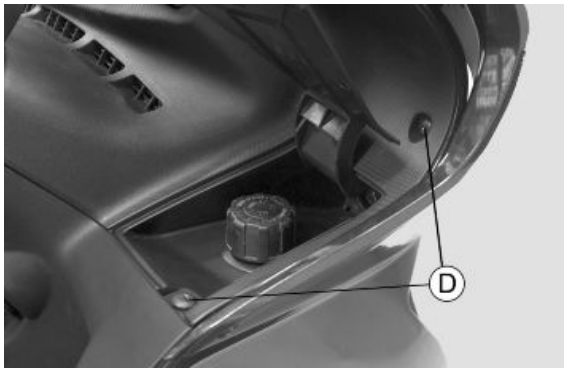
- Working from both vehicle sides, undo and remove the screw «**B**».



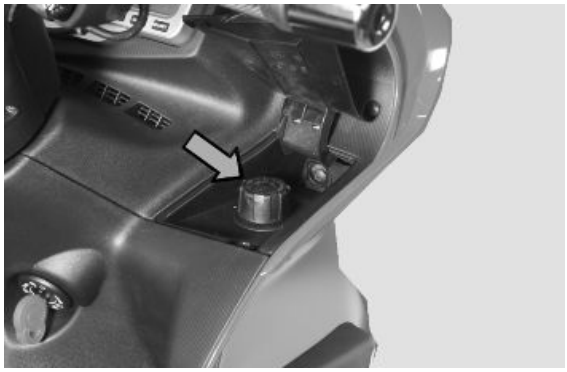
- Undo and remove the two screws «**C**» placed on and inside the glove compartment.



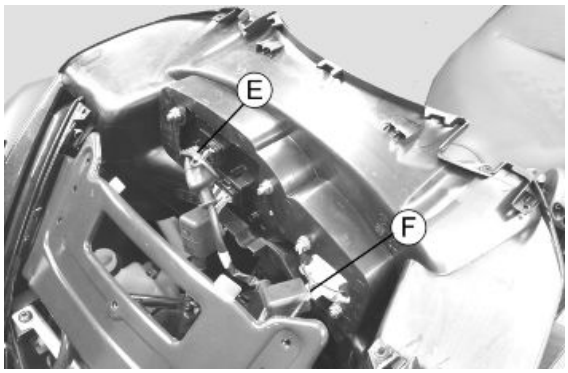
- Undo and remove the two screws «**D**» placed on and inside the coolant loading compartment.



- Undo and remove the expansion tank cap and the gasket below.



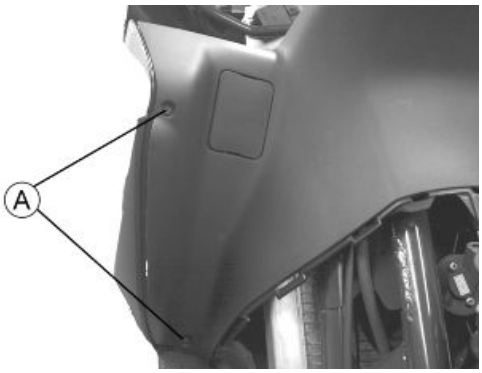
- Remove the instrument panel and release the instrument panel connector «**E**» and the instrument panel lighting connector «**F**». Remove the instrument panel.



LOWER SHIELD BACK PLATE:

- Remove the central tunnel (see CENTRAL CHASSIS COVER).
- Remove the instrument panel (see SHIELD BACK PLATE).

- Working from both vehicle sides, undo and remove the two screws «**A**».



- Turn the key switch frame anticlockwise (it may be necessary to use pliers), releasing the catch.

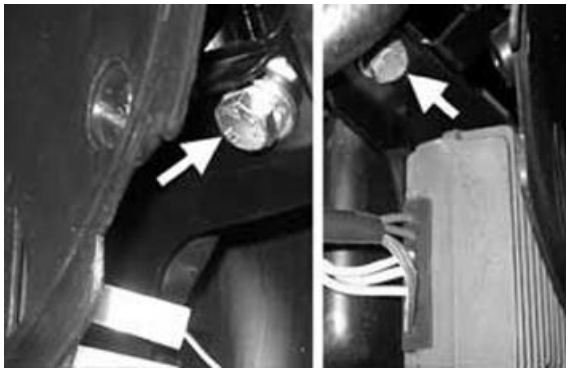
Removing the ignition key-switch when on *off*

- Remove the lower shield back plate.
- Unscrew the seat opening transmission from the side.
- Remove in advance the ring of the immobiliser antenna.
- Loosen the 2 hex. socket head screws and remove the complete switch.

- From the underside it is possible to loosen the 3 retaining screws and to release the 2 locking tabs to raise the mounting plate of the steering lock strut.
- The latter has a retaining tab with cylindrical teeth that cannot be replaced.

Front wheel housing

To remove the front wheel housing, proceed as follows:
- Remove the spoiler.
- Remove the front fork.
- Remove the plate supporting bracket for the horn and voltage regulator by loosening the two fixing screws shown in the figure in order to release the two lower retainers of the wheel housing.

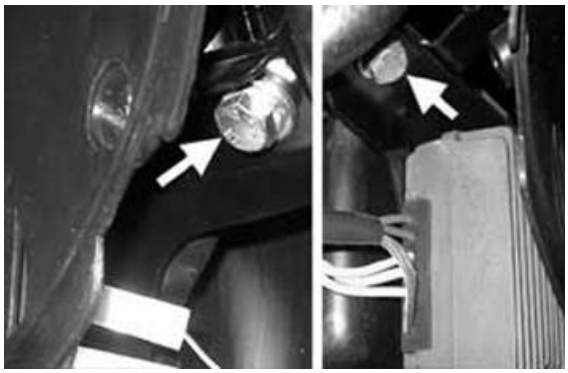


- Remove the upper fixing screw of the wheel housing to permit movement.

- In order to remove the wheel housing it is necessary to remove the front brake hose to the tank and combination with the splitter.

To remove the front wheel housing, proceed as follows:

- Remove the spoiler.
- Remove the front fork.
- Remove the plate supporting bracket for the horn and voltage regulator by loosening the two fixing screws shown in the figure in order to release the two lower retainers of the wheel housing.



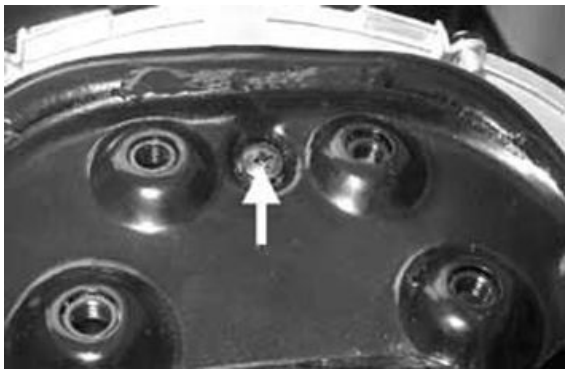
- Remove the upper fixing screw of the wheel housing to permit movement.

- In order to remove the wheel housing it is necessary to remove the front brake hose to the tank and combination with the splitter.

Taillight assy.

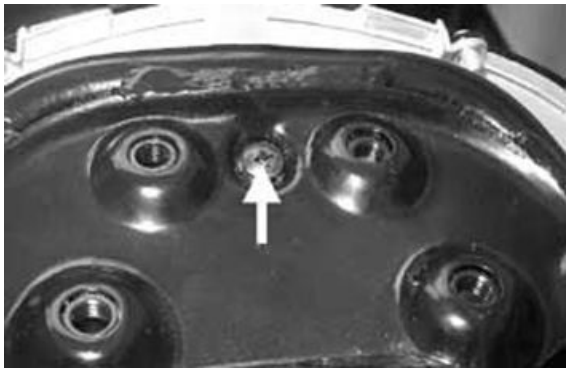
To remove the rear light assembly, proceed as follows:

- Remove the rear upper central cover.
- Remove the handgrips and the upper side fairings.
- Undo and remove the central screw.

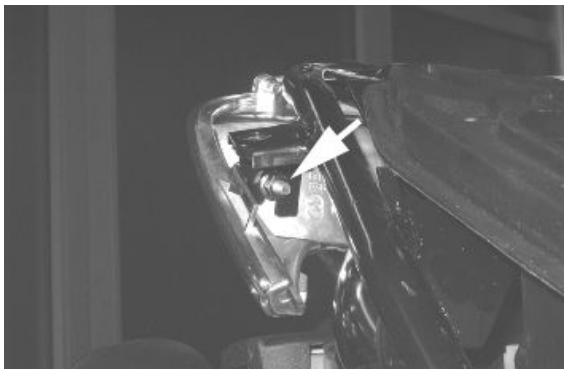


- Using a jointed wrench between the helmet compartment and the chassis pipes, loosen the two rear fixing nuts and then disconnect the light stud bolts from the support extensions.
- Remove the light and disconnect the bulb holder by turning it through 30° in anticlockwise direction.

To remove the rear light assembly, proceed as follows:
- Remove the rear upper central cover.
- Remove the handgrips and the upper side fairings.
- Undo and remove the central screw.



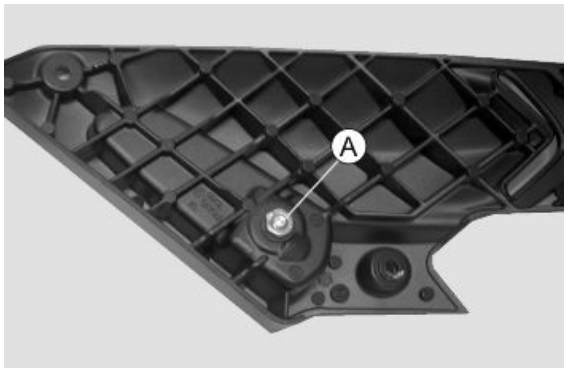
- Using a jointed wrench between the helmet compartment and the chassis pipes, loosen the two rear fixing nuts and then disconnect the light stud bolts from the support extensions.
- Remove the light and disconnect the bulb holder by turning it through 30° in anticlockwise direction.



Footrest

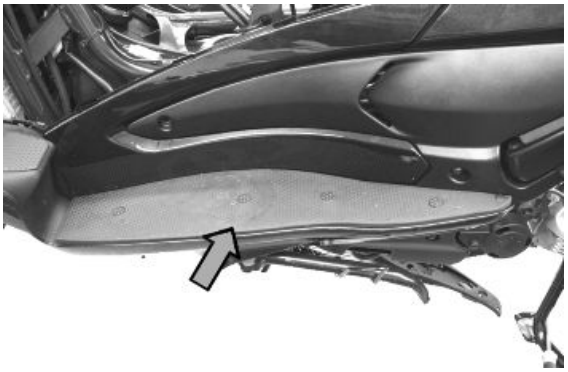
The footrest comprises a right and left footrest, a passenger footrest and a rider footrest. The whole procedure is described below:

PASSENGER FOOTREST:
- Remove the side fairings.
- Unscrew the nut «**A**» from both vehicle sides and release the footrests.

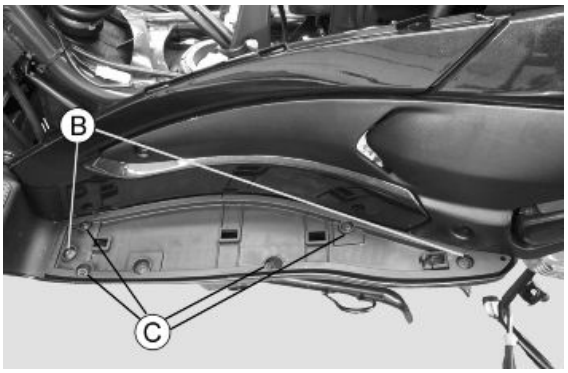


RIGHT AND LEFT FOOTREST:

- Working from both vehicle sides, remove the mat.



- Undo and remove the two screws «**B**» and the four screws «**C**».
- Remove the footrest

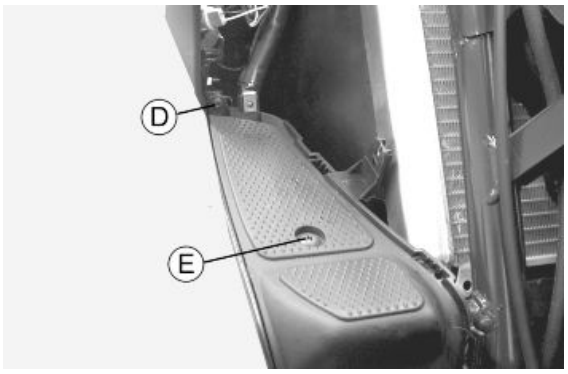


RIDER FOOTREST:

To remove the rider footrest, proceed as follows:

- Remove the central cover.
- Remove the shield back plate.
- Remove the right and left footrest (see FOOTREST).

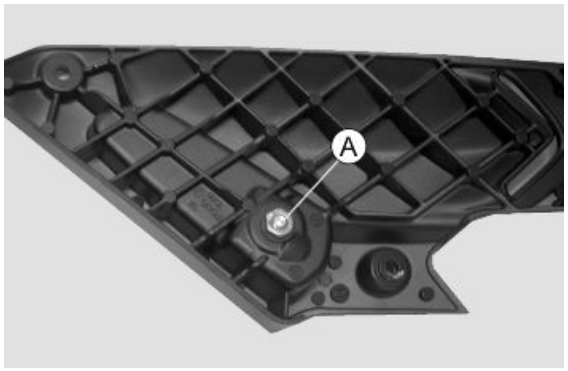
- Undo the screw «**D**» and the screw «**E**» and remove the rider footrest.



The footrest comprises a right and left footrest, a passenger footrest and a rider footrest. The whole procedure is described below:

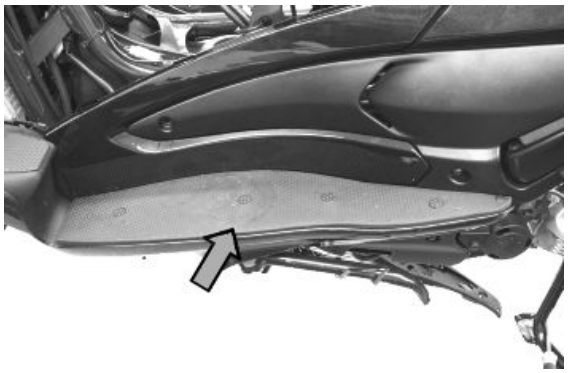
PASSENGER FOOTREST:

- Remove the side fairings.
- Unscrew the nut «**A**» from both vehicle sides and release the footrests.

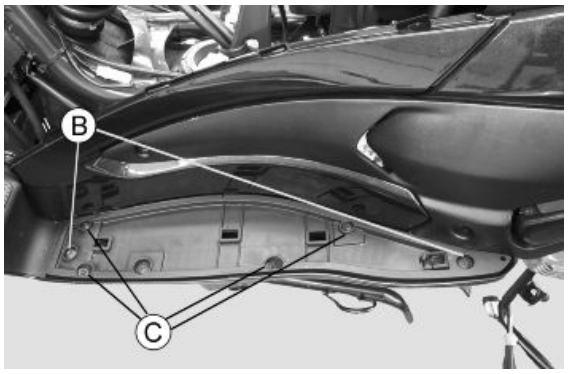


RIGHT AND LEFT FOOTREST:

- Working from both vehicle sides, remove the mat.



- Undo and remove the two screws «**B**» and the four screws «**C**».
- Remove the footrest

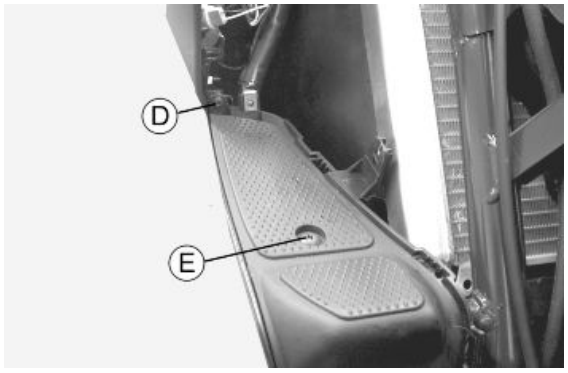


RIDER FOOTREST:

To remove the rider footrest, proceed as follows:

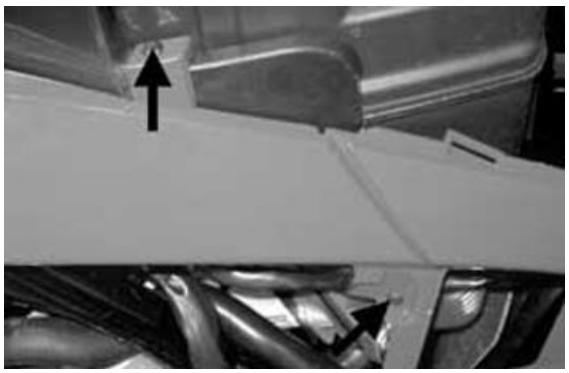
- Remove the central cover.
- Remove the shield back plate.
- Remove the right and left footrest (see FOOTREST).

- Undo the screw «**D**» and the screw «**E**» and remove the rider footrest.

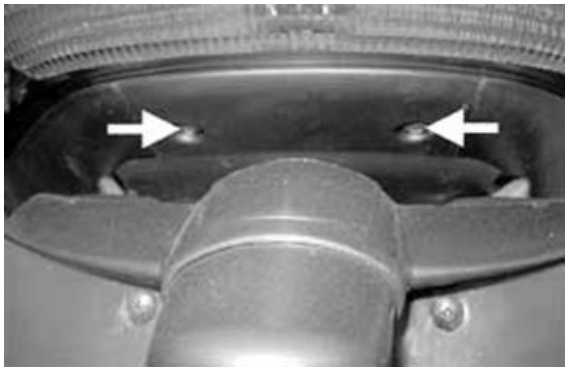


Side fairings

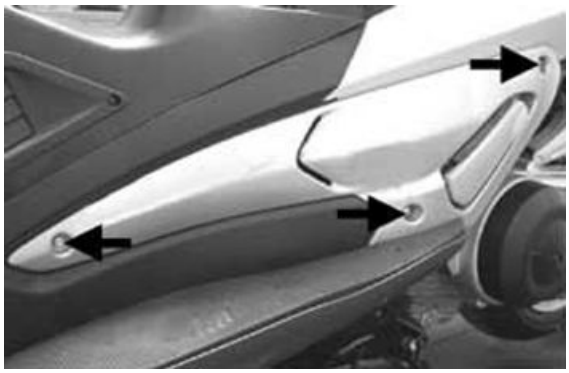
- Remove the rear central cover.
- Remove the passenger handles.
- Remove the lower cover.



- Remove the lower side cover.
- Remove the eight screws shown in the figure (four on each side).
- Pull out the fairing.

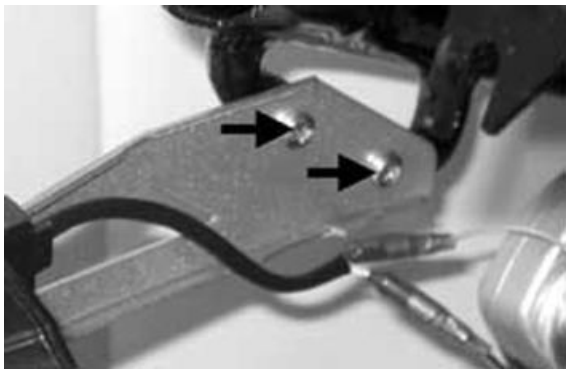


- Remove the three screws indicated in the figure.

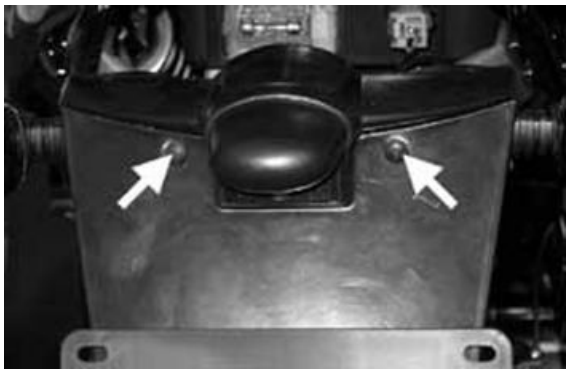


License plate holder

- Remove the rear lower central cover.
- Remove the four fixing screws (two per side) and disconnect the electric connectors.

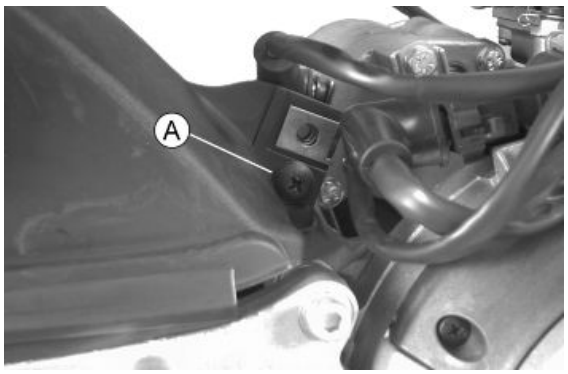


- To access the license plate light bulb, remove the two fixing screws of the support rear cover and extract the complete bulb holder.

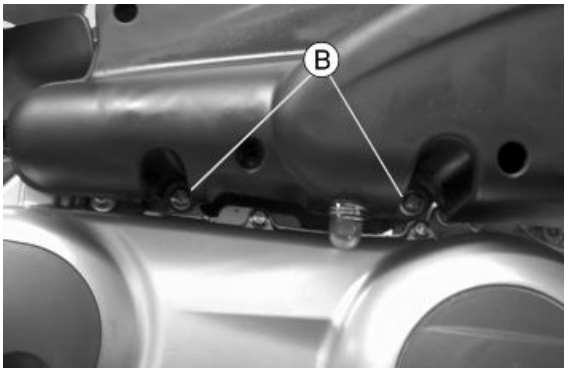


Rear mudguard

To remove the rear mudguard, proceed as follows:
- From the right side of the vehicle, undo the screw «**A**».



- From the left side of the vehicle, undo the two screws «**B**».
- Remove the rear mudguard.

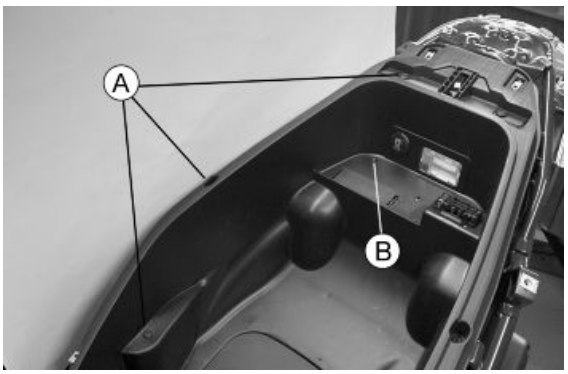


Helmet bay

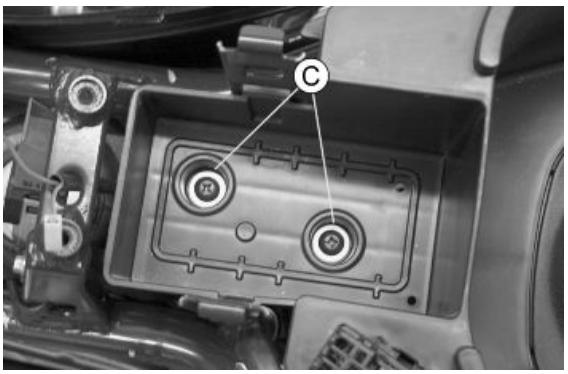
To remove the helmet compartment, proceed as follows:

- Remove the saddle.
- Remove the battery.
- Remove the rear upper central cover.
- Remove the handgrips and top side fairings.

- Working from both vehicle sides, undo the three screws «**A**» and the screw «**B**».



- Undo and remove the two screws «**C**» from the battery compartment.
- Lift the helmet compartment from the rear side and remove the saddle lock.



- Disconnect the connectors of the power socket and the under seat light.
- Remove the plug socket due to the interference with the chassis.
- Remove the fuse box releasing the side hook teeth.
- Remove the complete helmet compartment.

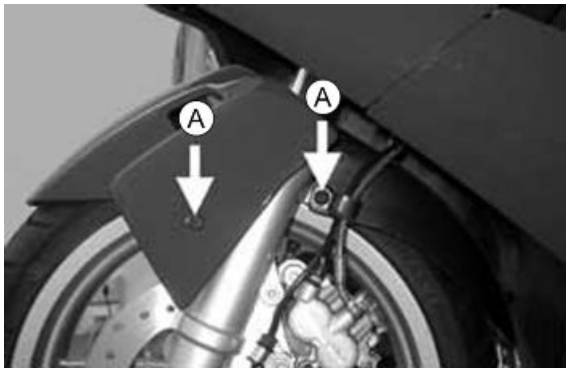
Front mudguard

- Working from both vehicle sides, undo and remove the two screws «**A**».

Slide the mudguard to the front part of the vehicle.

CAUTION

WHEN REFITTING PAY ATTENTION TO THE CORRECT POSITION OF THE PIPE RETAINING STRAPS.



Fuel tank

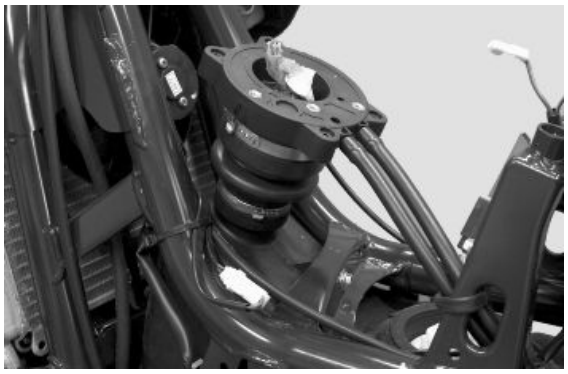
To remove the fuel tank, proceed as follows:

NOTE

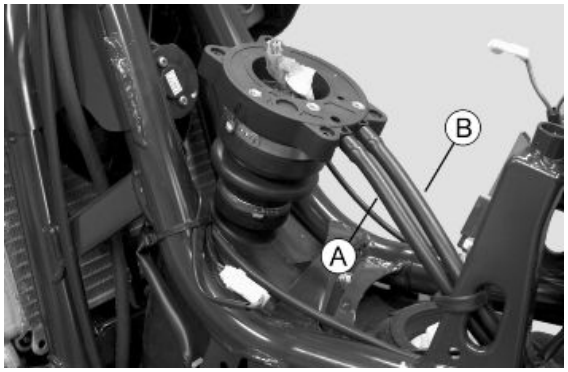
THIS OPERATION SHOULD PREFERABLY BE PERFORMED WITH THE TANK EMPTY.

- Remove the shield back plate.
- Remove the central frame cover.
- Remove the footrest.
- Remove the spoiler.

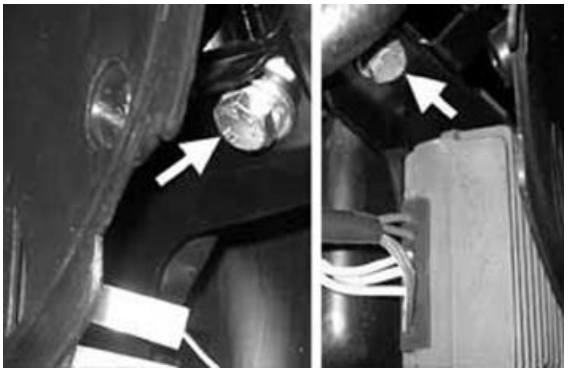
- Remove the filler unscrewing the two tank retaining straps.



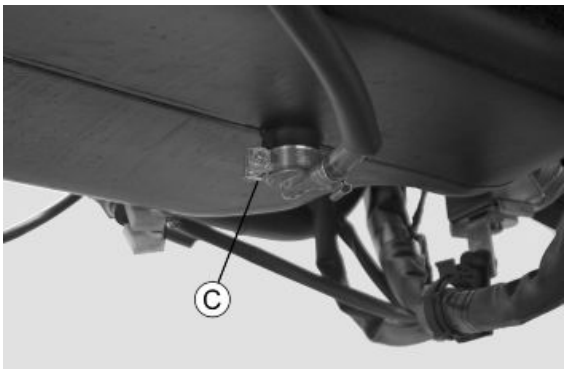
- Remove the "too full" pipe «**A**» and the tank ventilation pipe «**B**».



- Remove the horn plate support bracket and the voltage regulator unscrewing the two nuts shown in the figure.

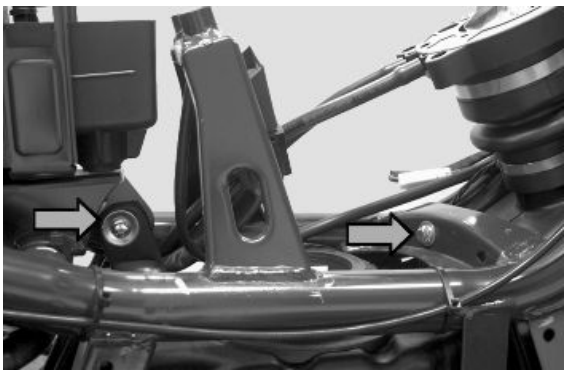


- Release the fuel pipe removing the clamp «**C**».



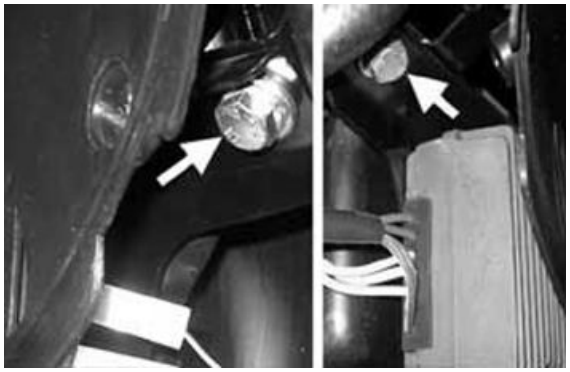
- Disconnect the fuel probe connector.

- Undo the two tank fixing screws.
- Remove the tank through the front lower part of the vehicle.



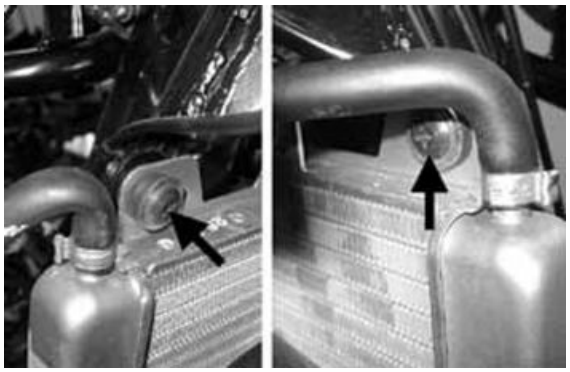
Radiator fan

- Remove the spoiler.
- Remove the front fork.
- Remove the plate supporting bracket for the horn and voltage regulator by loosening the two fixing screws shown in the figure in order to release the two lower retainers of the wheel housing.



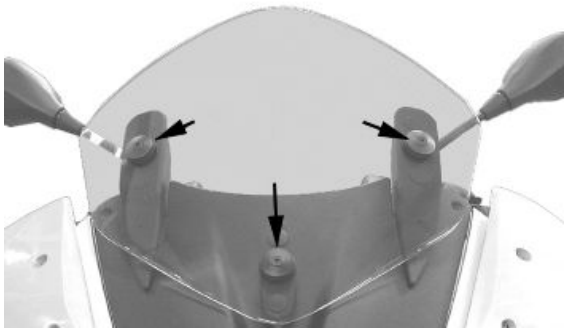
- Remove the upper fixing screw of the wheel housing to permit movement.

- Prepare a container to collect the coolant.
- Remove the feed and return hoses from the expansion tank.
- Remove the coolant feed and return hoses from the radiator.
- Remove the retaining screws of the radiator to the frame shown in the figure.
- Disengage the complete radiator and the electric fan.



Flyscreen

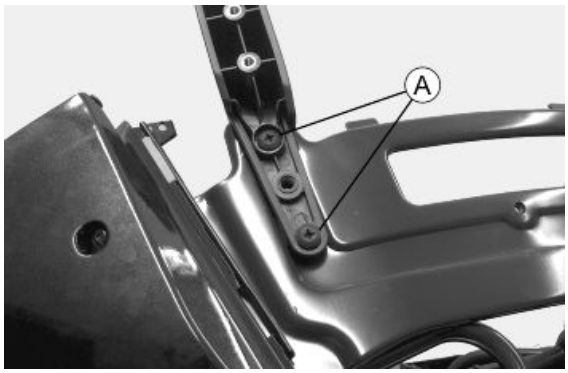
- Remove the three hex. socket head screws, then remove the windshield together with the rubber rings.



To remove the windshield supports, proceed as follows:

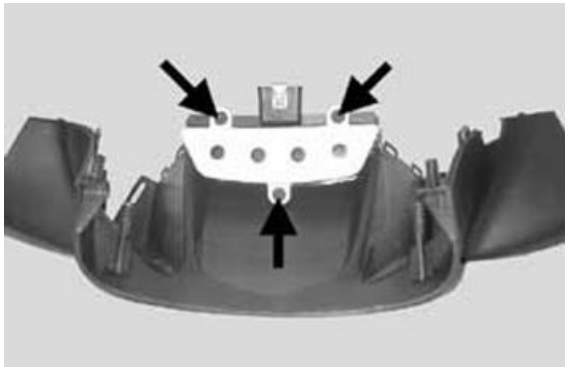
- Remove the caps and the gaskets on the two windshield supports.
- Remove the FRONT UPPER FRAME.

- Working from both vehicle sides, undo and remove the two screws «**A**».
- Remove the supports.



Pilot lights kit

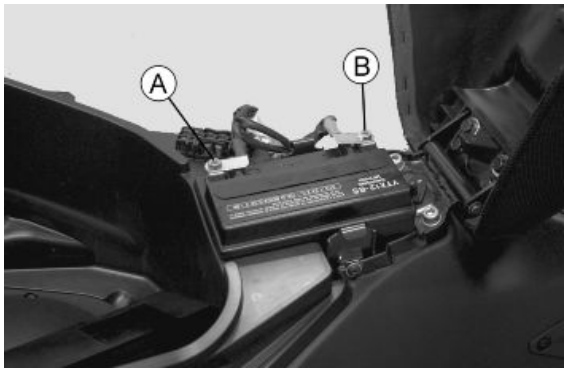
- Remove the front handlebar cover.
- Remove the three screws shown in the figure, then slide off the complete unit from the front handlebar cover.



Battery

- Remove the elastic strap and the battery cover.

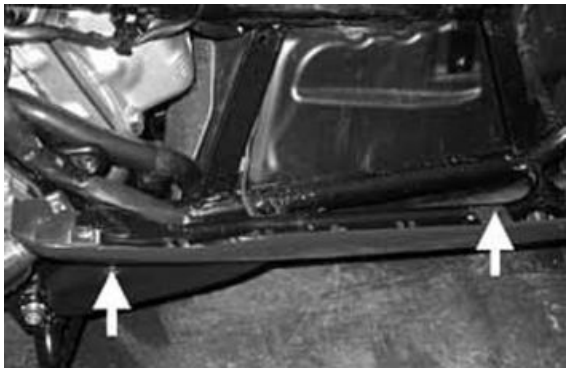
- First disconnect the negative terminal «**A**», then the positive terminal «**B**».



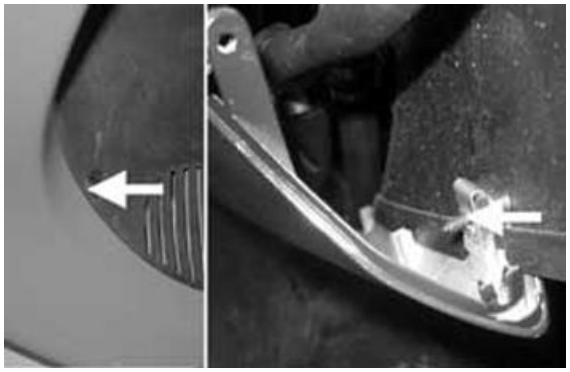
- Remove the battery.

Lower cover

- Remove the two screws of the lower spoiler (long type).
- Remove the 2 screws located under the footrests.



- Remove the 4 union screws with the front wheel housing cover.
- Pull the spoiler from the lower part of the scooter.



INDEX OF TOPICS

PRE-DELIVERY	PRE DE

Carry out the listed tests before delivering the vehicle.

Warning - Handle fuel with care.

Aesthetic inspection

Appearance check:

- Paintwork
- Fitting of plastics
- Scratches
- Dirt

Tightening torques inspection

- Visually check that there is a yellow mark on the following clamps:

FRONT WHEEL

- Wheel pin fixing nut
- Safety screws on left fork leg

FRONT BRAKE

- Brake pipe to brake calliper fitting
- Calliper to calliper support fixing screws
- Calliper to fork support fixing screws

SWINGING ARM

- Nut fixing swinging arm pin to engine

COOLING SYSTEM

- Water pump cover - delivery pipe fixing clamp
- Water pump cover - return pipe fixing clamp

REAR WHEEL

- Screws fixing wheel to hub

REAR BRAKE

- Brake pipe - brake calliper fitting
- Calliper - calliper support fixing screws
- Engine - calliper support fixing screws

REAR SUSPENSION

- Left shock absorber lower retainer
- Right shock absorber lower retainer

MUFFLER SUPPORTING ARM

- Muffler- supporting arm fixing screws
- Engine- supporting arm fixing screws

Electrical system

• Main switch

• Lights: high-beam lights, low-beam lights, taillights (front and rear) and relevant warning lights

- Headlight adjustment according to the regulations currently in force

• Front and rear stop light buttons and relative light •Turn indicators and relative telltales

• Instrument lighting

• instruments: fuel and temperature indicator

•Instrument panel lights

• Horn

• Electrical start up

• Engine stopping with emergency stop switch

• electric saddle opening button

CAUTION

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS THE LIFE OF THE BATTERY.

CAUTION

WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE.

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING.
IN CASE OF CONTACT WITH YOUR EYES OR SKIN, RINSE WITH ABUNDANT WATER FOR ABOUT 15 MINUTES AND SEEK IMMEDIATE MEDICAL ATTENTION.
IF IT ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP THEM AWAY FROM NAKED FLAMES, SPARKS AND CIGARETTES. IF THE BATTERY IS CHARGED IN A CLOSED PLACE, TAKE CARE TO ENSURE ADEQUATE VENTILATION. ALWAYS PROTECT YOUR EYES WHEN WORKING CLOSE TO BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

Levels check

Level check:

- Hydraulic brake system liquid level.

- Rear hub oil level

- Engine coolant level

- Engine oil level

Road test

Test ride

- Cold start
- Instrument operations
- Response to the throttle control
- Stability on acceleration and braking
- Rear and front brake efficiency
- Rear and front suspension efficiency
- Abnormal noise

Static test

Static control after the test ride:

• Hot engine restart

• Minimum seal (turning the handlebar)

• Uniform steering rotation

• Possible losses

• electric radiator fan operation

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES OR TYRES MAY BURST.

Functional inspection

Functional Checks:

• Hydraulic braking system: lever travel

• Clutch: proper functioning check

• Engine: proper general functioning and no abnormal noise check

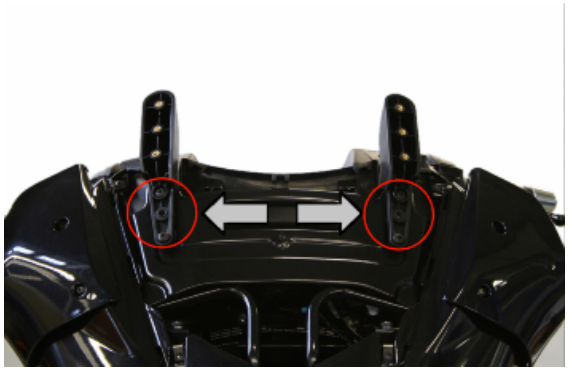
• Other: papers check, chassis and engine number check, tools and equipment, licence plate fitting, lock check, tyre pressure check, rear-view mirror and any accessory fitting

Specific operations for the vehicle

Windshield fitting:

- Remove the legshield upper cover.
- Fit the indicated nut in the seat at the back of the windshield support brackets.

- With the screws supplied fasten the windshield support brackets to the front frame .
- Fit the legshield upper cover.

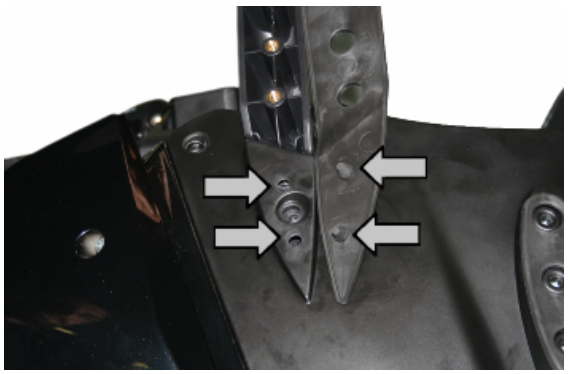


- Remove the protection film from the windshield, fit the rubber buffers in the three holes.

- Fit the three plastic spacers in the three rubber buffers.

- Fit the central protection.

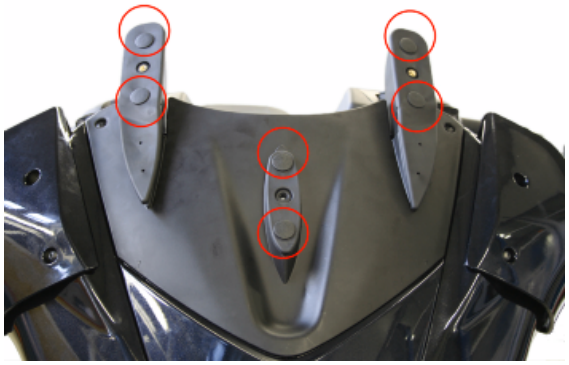
- Fit the rubber protection on the windshield support brackets, make sure that the clamps are correctly snapped in the holes.



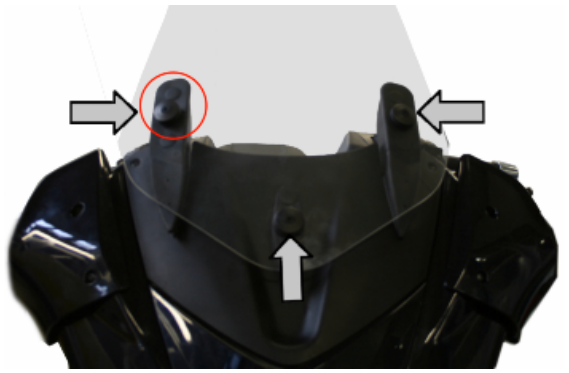
NOTE

THE WINDSHIELD CAN BE ADJUSTED TO THREE POSITIONS. HEIGHT MAY VARY DEPENDING ON THE RETAINER USED.

- Fit the supplied cover caps in order to cover the holes not used.



- Fit the windshield to the vehicle with the three screws supplied.



INDEX OF TOPICS

TIME	TIME

Engine

Crankcase

Crankshaft

Cylinder assy.

Cylinder head assy.

Rocker arms support assy.

Cylinder head cover

Oil filter

Flywheel cover

Driven pulley

Oil pump

Final gear assy.

Driving pulley

Transmission cover

Starter motor

Flywheel magneto

Butterfly valve

Exhaust pipe

Air cleaner

Frame

Centre-stand

Legshield spoiler

Side fairings

Rear cover

Central cover

Mudguard

Fuel tank

Rear shock-absorber

Handlebar covers

Handlebar components

Swing-arm

Seat

Instrument panel

Turn signal lights

Front wheel

Rear wheel

Electric devices

Helmet bay

Front suspension

Cooling system

Braking system

A

Accessories: *66*
Air filter: *41*

B

Battery: *64*, *76*, *86*, *88*, *89*, *275*
Brake: *235*, *237*, *239*, *240*, *242*, *243*, *246*
Brake calliper: *235*, *237*
Brake disc: *239*, *240*
Brake pads: *242*, *243*
Brake pump: *246*
Bulbs:
Bushings:

C

Clutch: *52*, *107–109*, *115*
Coil: *192*
Connectors: *91*
coolant: *197*
Coolant: *197*
Crankcase: *13*, *149–151*, *153*, *285*
Crankshaft: *13*, *149*, *151*, *152*, *157*, *285*
Cylinder: *11*, *17*, *135*, *138–140*, *143*, *285*

E

Electric fan: *249*
Electrical system: *10*, *55*, *279*
Engine oil: *42*
Exhaust: *98*, *173*, *286*

F

Fairings: *269*, *286*
Fork: *210*
Front wheel: *206*, *209*, *264*, *287*
Fuel: *174*, *183*, *272*, *286*
Fuses: *82*

H

Handlebar: *209*, *254*, *255*, *286*
Head cover: *285*
Headlight: *48*, *256*
Horn: *79*
Hub oil: *40*

I

Identification: *8*
Instrument panel: *255*, *286*

L

Lambda probe: *200*
License plate holder: *270*

M

Maintenance: *7*, *38*
Mudguard: *270*, *272*, *286*

O

Oil filter: *44*, *285*
Oil sump: *162*, *163*

R

Radiator: *274*
Rear wheel: *225*, *226*, *287*
Recommended products:

S

Scheduled maintenance:
Shock absorbers: *232*
Side fairings: *269*, *286*
Side stand: *233*
Spark plug: *39*, *75*
Stand: *233*
Starter motor: *131*, *135*, *285*

T

Tank: *272*, *286*
Technical data:
Transmission: *10*, *52*, *104*, *121*, *285*
Turn indicators: *67*
Tyre pressure:
Tyres: *10*